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# **Modem***Module*

*ModemModule*  
**Model MT3334SMI Evaluation Kit**

**Data/Fax Socketed Modem**

**Developer's Guide**



## Developer's Guide

88312201 Revision B

ModemModule (Model MT3334SMI)

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### Record of Revisions

Revision	Description
<b>A</b> (10/22/99)	Manual released. All pages at revision A.
<b>B</b> (12/10/99)	Added the &V command to the AT command set and added Appendix B which provides instructions for developing a customized flash programming utility. All pages at revision B.

### Patents

This Product is covered by one or more of the following U.S. Patent Numbers: **5.301.274; 5.309.562; 5.355.365; 5.355.653; 5.452.289; 5.453.986** . Other Patents Pending.

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# Modem *Module*

## Chapter 1 - Introduction and Description

## Introduction

The MT3334SMI socket modem provides a fully-integrated data and fax communications design for communications over wide area networks using dial-up phone lines and the Internet.

This guide provides the Service Class 1 standard defining the commands that the developer can use to configure and control a fax/data modem and the responses (result codes) that the fax/data modem issues in response to the commands. This guide also provides the developer with specific Class 2 fax command protocol used to control the sending and receiving of faxes.

## Product Description

The MT3334SMI is a standard 64-pin Socket Modem (Figure 1-1 illustrates the MT3334SMI in relationship to Multi-Tech's Demo board) used for integrating data and fax communications. It provides:

- Low power consumption
- A serial TTL level interface
- Full-featured fax and datacomm operation
- A very small footprint for embedded applications

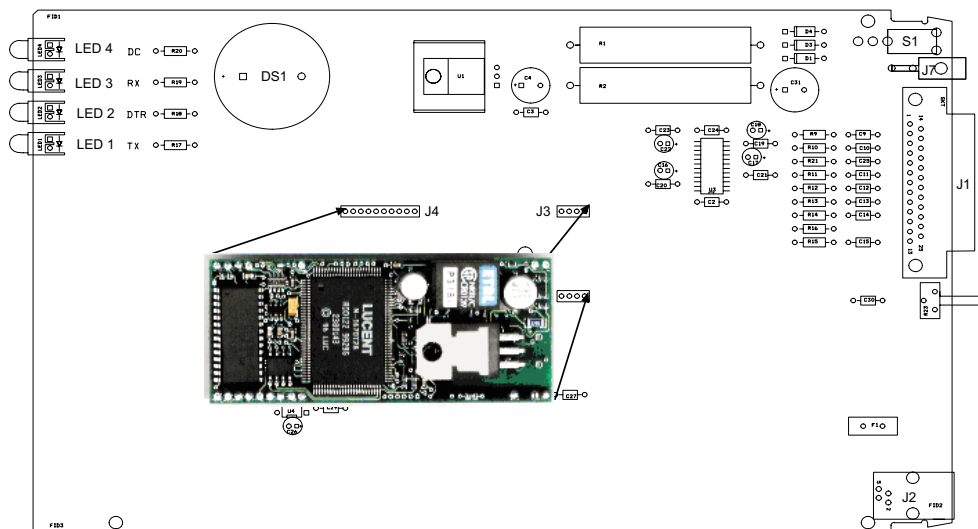


Figure 1-1. MT3334SMI and Demo Board

## Features

- Complete fax / modem solution: includes the controller, data pump, and DAA
- Modem downloads at 33.6 Kbps via enhanced V.34 server and uploads at 33.6 Kbps (enhanced V.34)
- Supports V.42 error correction with V.42bis or MNP Class 5 data compression
- Supports industry-standard AT-style commands
- Standard TTL serial interface supporting DTE transfer speeds to 230.4 Kbps
- Remote configuration, diagnostic tests, Distinctive Ring, 3-number storage for automatic dialing, and Flash memory for firmware updates.
- Includes NOVRAM for stored parameters

# Technical Specifications

The ModemModule meets the following specifications:

## Data Rates

<b>Client-to-Server</b>	DataComm: supports enhanced V.34 (33.6K), V.32bis (14.4K), V.32 (9600), V.22bis (2400), or slower speed connection for download speeds, and upload speeds to 33.6 Kbps via enhanced V.34.
<b>Client-to-Client</b>	33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800, 2400, 1200, 0-300 bps
<b>Fax Data Rates</b>	14,400, 9600, 7200, 4800, 2400, 300 bps
<b>Data Format</b>	Serial, binary, asynchronous
<b>Modem Compatibility</b>	ITU-T V.34 enhanced, V.34, V.32bis, V.32, V.22bis, V.22; Bell 212A and 103/113; ITU-T V.29, V.42, V.42bis; ITU-T V.21 & V.23 in international versions
<b>Fax Compatibility</b>	ITU-T Group 3, Class 1 and 2, T.4, T.30, V.21, V.27ter, V.29, V.17, and TIA/EIA TR29.2
<b>Error Correction</b>	ITU-T V.42 (LAP-M or MNP 3-4)
<b>Data Compression</b>	ITU-T V.42bis (4:1 throughput), MNP 5 (2:1 throughput)
<b>Speed Conversion</b>	Serial port data rates adjustable to 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200, and 230,400 bps
<b>Modes of Operation</b>	Fax online modes; full duplex over dial-up lines; data mode, command mode, and online command mode; V.54 Test mode.
<b>Flow Control</b>	XON/XOFF (software), RTS/CTS (hardware)
<b>Intelligent Features</b>	Fully AT command compatible; autodial, redial, repeat dial; pulse or tone dial; dial pauses; auto answer; adaptive line probing; automatic symbol and carrier frequency during start-up, retrain, and rate renegotiation; DTMF detection; call status display, auto-parity and data rate selections; keyboard-controlled modem options; non-volatile memory; on-screen displays for modem option parameters; command lines of up to 40 characters each; help menus; remote configuration; DTR dialing.
<b>Command Buffer</b>	40 characters
<b>Data Modulation</b>	FSK at 300 bps, PSK at 1200 bps, QAM at 2400, 4800, and 9600 bps (non-trellis), QAM with trellis-coded modulation (TCM) at 9600, 12,000, 14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, and 33,600, bps
<b>Fax Modulation</b>	V.21 CH2 FSK at 300 bps (half duplex) V.27ter DPSK at 4800 and 2400 bps V.29 QAM at 9600 and 7200 bps V.17TCM at 14400, 12000, 9600, and 7200 bps
<b>Carrier Frequencies</b>	1600, 1646, 1680, 1800, 1829, 1867, 1920,
<b>ITU-T V.34</b>	1959, 2000 Hz
<b>Carrier Frequencies</b> <b>ITU-T V.32bis/V.32</b>	1800 Hz
<b>Carrier Frequencies</b>	Transmit originate: 1200 Hz
<b>V.22bis/V.22 or</b> <b>Bell 212A Standard</b> <b>(2400 &amp; 1200 bps)</b>	Transmit answer: 2400 Hz Receive originate: 2400 Hz Receive answer: 1200 Hz

**Carrier Frequencies  
ITU-T V.23  
(1200 bps)**

Transmit originate:	390 Hz mark 450 Hz space
Receive originate:	1300 Hz mark 2100 Hz space
Transmit answer:	1300 Hz mark 2100 Hz space
Receive answer:	390 Hz mark 450 Hz space

**Carrier Frequencies  
ITU-T V.21  
(0–300 bps)**

Transmit originate:	980 Hz mark 1180 Hz space
Receive originate:	1650 Hz mark 1850 Hz space
Transmit answer:	1650 Hz mark 1850 Hz space
Receive answer:	980 Hz mark 1180 Hz space

**Carrier Frequencies  
Bell 103/113  
(0–300 bps)**

Transmit originate:	1270 Hz mark 1070 Hz space
Receive originate:	2225 Hz mark 2025 Hz space
Transmit answer:	2225 Hz mark 2025 Hz space
Receive answer:	1270 Hz mark 1070 Hz space

**Fax Carrier  
Frequencies**

V.21 Ch2 (half duplex):  
1650 Hz mark, 1850 HZ space for transmit originate  
1650 HZ mark, 1850 Hz space for transmit answer  
V.27ter: 1800 Hz originate/answer  
V.29 QAM: 1800 Hz originate/answer  
V.17 TCM: 1800 Hz originate/answer

**Transmit Level** -11 dBm (dial-up)

**Frequency Stability** ±0.01%

**Receiver Sensitivity** -43 dBm under worst-case conditions

**AGC Dynamic Range** 43 dB

**Interface** Serial interface for EIA RS-232C/ITU-T V.24/V.28

**Diagnostics** Local analog loop, local digital loop, remote digital loop.

**Weight** 0.02 Kg. (0.04 lb.)

**Dimensions:** 1.045" x 2.541" x 0.680"  
(2.7 x 6.5 x 1.8 cm)

**Power consumption:** Typical: 215 mA (1.3 W @ 5v DC)  
Maximum: 420 mA (2.1 W @ 5.25v DC)

**Environmental:** 0-50° C; humidity range 20–90% (non-condensing)

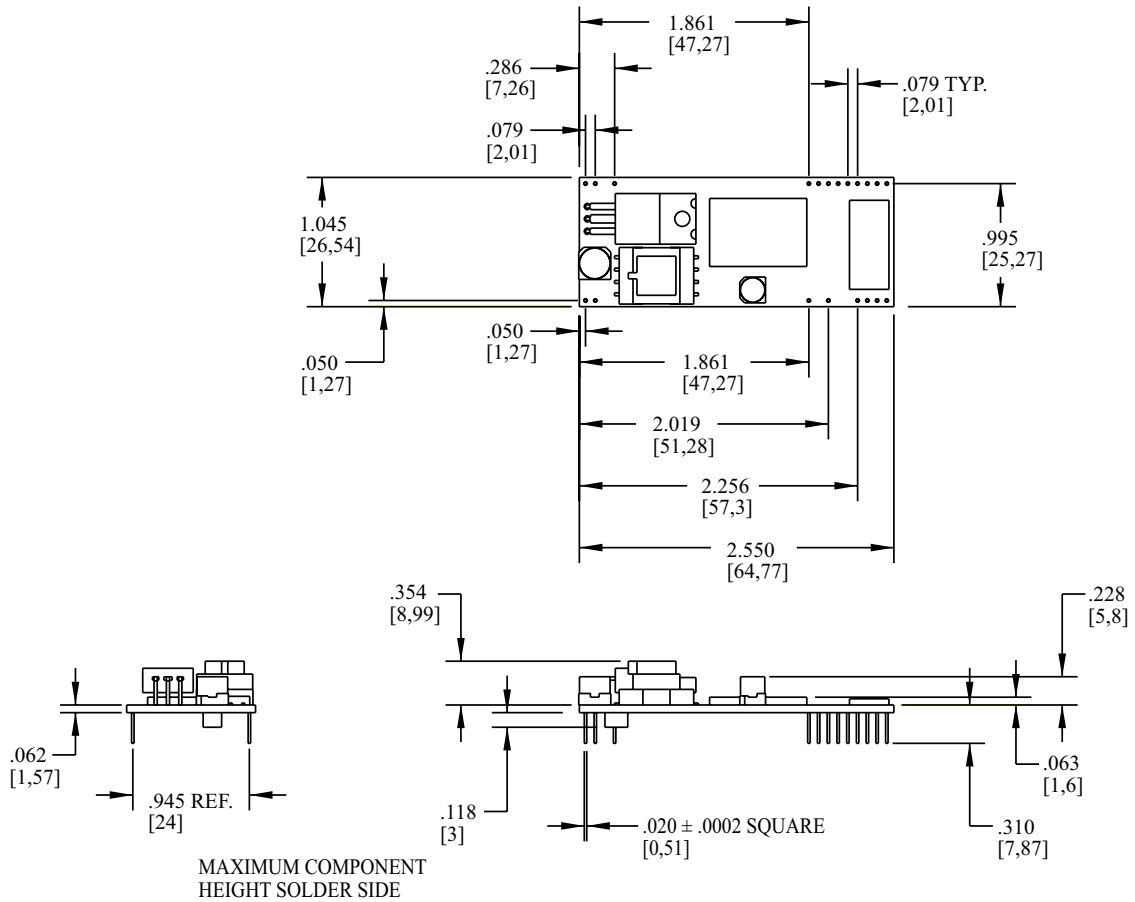
**Approvals\*:** UL 1950 approved  
FCC Part 68 approved  
Industry canada CS0s  
EN60950

\* Approvals are provided in controlled configurations and must be re-evaluated in end-user configurations.



# Physical Dimensions

Figure 1-2 illustrates the the physical dimensions of the MT3334SMI.



**Figure 1-2. MT3334SMI Physical Dimensions**

**CAUTION:** If any component(s) is placed under the socket modem or if any component(s) should extend to the point where part of it is under the socket modem, the component(s) must NOT exceed .060 inches in height.

# Test/Demo Board Specifications

The ModemModule Test/Demo Board kit includes a modem module, a power transformer for the test board, and a diskette (this Developer's Guide manual, etc.). Figure 1-3 illustrates the demo/test board and Figure 1-4 illustrates the Test/Demo board block diagram.

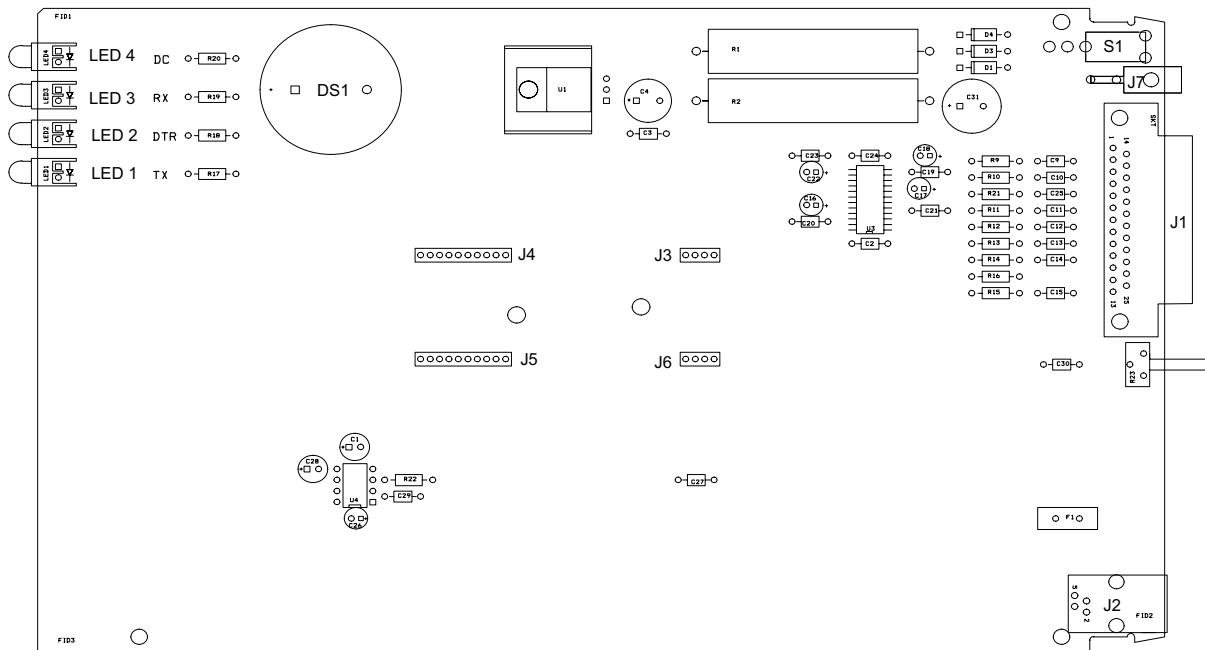


Figure 1-4. MT3334SMI Test/Demo Board

Designation	Function
DS1	Speaker
J1	25-Pos. DSUB
J2	6-Pin Mod. Jack (Line Jack)
J3, J6	4-Pos. Connector
J4, J5	10-Pos. Connector
J7	2-Pos. Header
LED1-LED4	Red LED
S1	SPST Switch

## Test/Demo Board Block Diagram

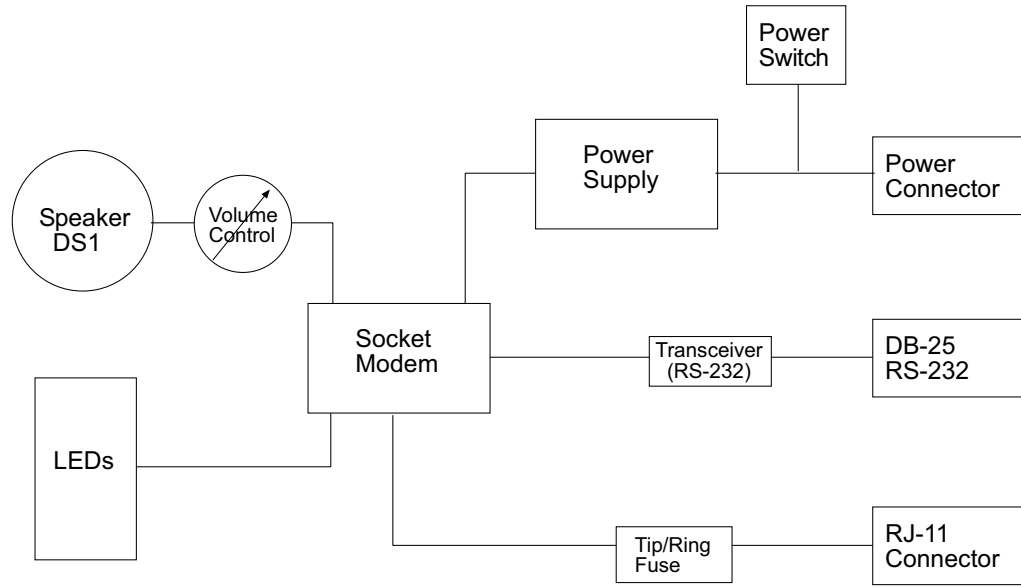


Figure 1-4. MT3334SMI Test/Demo Board Block Diagram

# MT3334SMI Pin-out

The MT3334SMI uses a 20-pin interface to provide an on-board DAA with tip and ring connections, audio circuit for call-progress monitoring, LED driver for call status annunciation, and serial interface via TTL level signals.

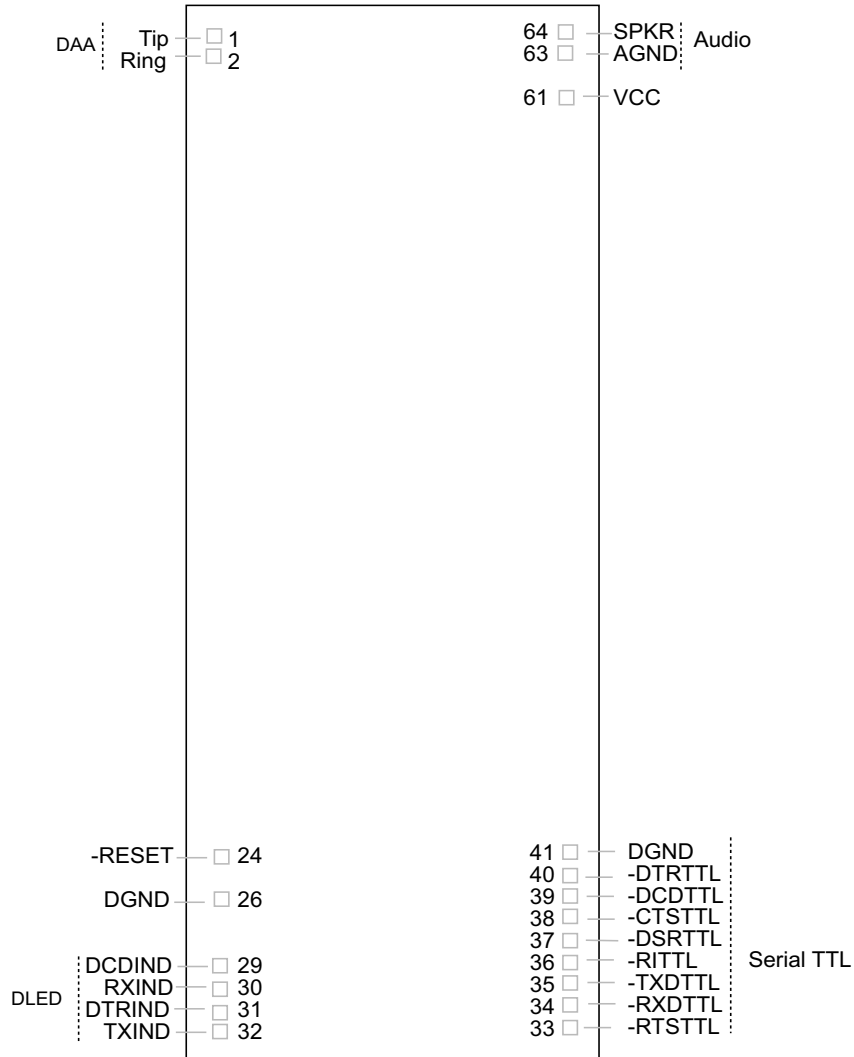


Figure 1-5. MT3334SMI Pinout

## Typical Application

The table below shows the MT3334SMI pinouts and Figure 1-6 illustrates a typical OEM application.

<u>Pin #</u>	<u>Circuit Type</u>	<u>Signal Description</u>	<u>Input/Output</u>
1	RJ-11 Jack	Tip	Input/Output
2	RJ-11 Jack	Ring	Input/Output
26	External Call Status LEDs	DGND	
29	External Call Status LEDs	DCD	Output
30	External Call Status LEDs	RX	Output
31	External Call Status LEDs	DTR	Output
32	External Call Status LEDs	TX	Output
33	Serial TTL	RTS	Input
34	Serial TTL	RXD	Output
35	Serial TTL	TXD	Input
36	Serial TTL	RI	Output
37	Serial TTL	DSR	Output
38	Serial TTL	CTS	Output
39	Serial TTL	DCD	Output
40	Serial TTL	DTR	Input
41	Serial TTL	DGND	
61	Power	VCC	
63	Audio	AGND	
64	Audio	SPKR	

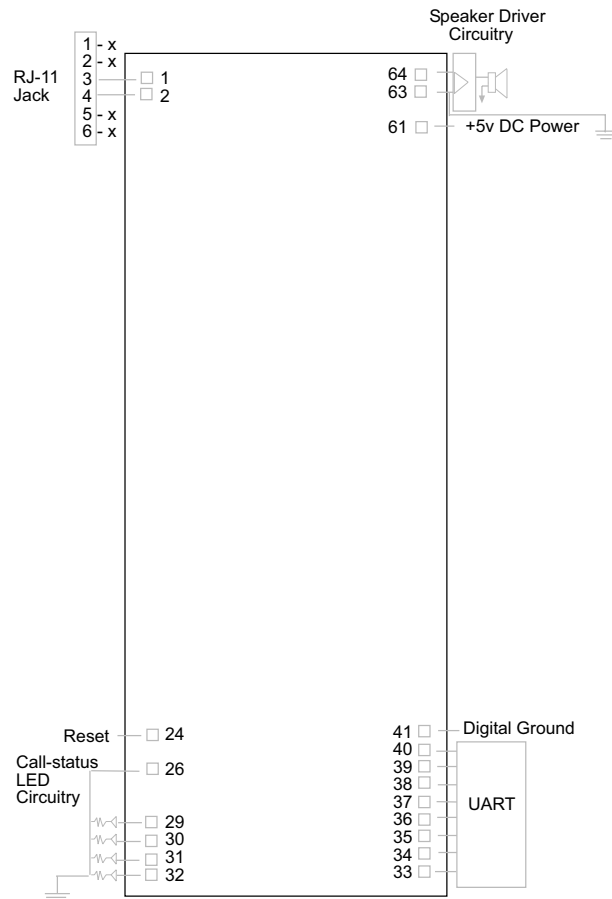


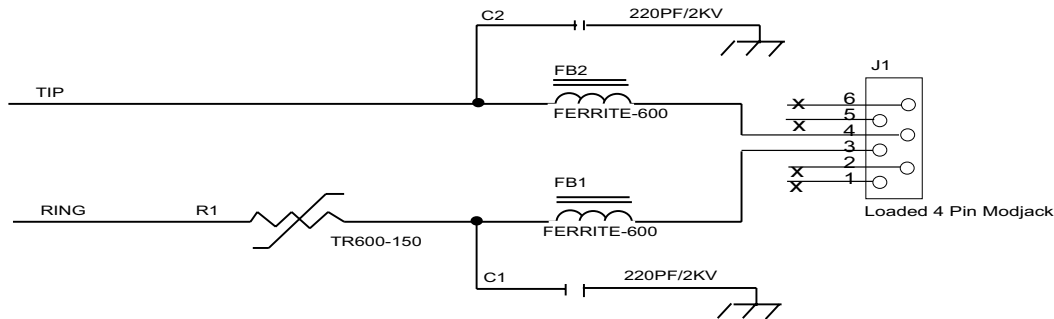
Figure 1-6. MT3334SMI Typical OEM Application

# MT3334SMI Design Considerations

This section discusses hardware considerations, PC board layout considerations, and Telecom labeling requirements.

## Hardware Considerations

**Disclaimer:** Multi-Tech Systems makes no warranty claims for vendor product recommendations listed below. Other vendor products may or may not operate satisfactorily. Multi-Tech System's recommended vendor products only indicate that the product has been tested in controlled conditions and were found to perform satisfactorily.



**Figure 1-7. Tip and Ring Ferrite Connections**

**EMC:** Surface mount ferrites are used on T&R (Tip and Ring) to mitigate emission levels out the RJ-11 cable. 220pF capacitors are also used on T&R to reduce the common mode emissions that may be present in certain systems. The ferrite and capacitors also aid in reducing the effects of transients that may be present on the line.

### Recommended Ferrite

Manufacturer – Associated Component Technology (ACT)  
Part # - YCB-1206

Manufacturer – Murata Erie  
Part # - BLM31A601SPT

### Recommended Capacitor

Manufacturer – Murata Erie  
Part # - GHM3045X7R221K-GC (Surface mnt)  
Part # - DE0807B221K-KH (Thru-hole device)

Manufacturer - Ever Grace Electronic Industrials  
Part # - YP221K2EA7PS

**Note:** The capacitors used on T&R must have a Y2 safety rating.

**Telecom:** The RJ-11 connector must meet FCC Part 68 requirements. Refer to FCC Part 68 section 68.500 subpart F for connector specifications. A self-healing fuse is used in series with line to help prevent damage to the DAA circuit. This fuse is needed for FCC Part 68 compliance.

### Recommended Connector

Manufacturer – Stewart  
Part # - 6446S/RP-30

### Recommended Fuse

Manufacturer – RayChem  
Part # - TR600-150

**Note:** The fuse is also needed to meet UL1950 3<sup>rd</sup> edition protection against overvoltage from power line crosses.

**Safety:** All creepages and clearances for the MT3334SMI have been designed to meet requirements of safety standards EN60950 and IEC950. The requirements are based on a working voltage of 250V. When the recommended DAA circuit interface is implemented in a third party design all creepage and clearance requirements must be strictly adhered to. The third party safety design must be evaluated by the appropriate national agency per the required specification.

User accessible areas: Based on where the third party design is to be marketed/sold or used, it may be necessary to provide an insulating cover over all TNV exposed areas. Consult with the recognized safety agency to determine the requirements.

**Notice:** Even if the recommended design considerations are followed, there are no guarantees that a particular system will comply with all the necessary regulatory requirements. It is imperative that specific designs be completely evaluated by a qualified/recognized agency.

### **Recommended Transceiver**

Manufacturer – Analog Devices  
Part # - ADM207EAR

## **PC Board Layout Considerations**

This section discusses the FCC Part 68 and Industry Canada CS-03 Telecom compliance of the Multi-Tech Systems, Inc. Model MT5634SM/SMI socketed modem module.

This module was tested by the NVLAP accredited KTL Dallas Inc. laboratory and conforms to the above said standards. The modem module was tested in the MultiTech MTASR3-200, a 3-modem asynchronous router that uses three socket modems for dial-up telephone access. The developer's guide (included on diskette) with the MT5634SM/SMI modem includes design specifications listing recommendations for the RJ-11 phone jack and fuse which are needed for FCC Part 68 compliance.

The MTASR3-200 tested has sockets for three modem modules each having traces of varying lengths out to the RJ-11 connectors. Trace lengths ranged from 1.97 to 3.15 inches. The trace widths were all 12 mil. Since three ports with varying trace lengths were tested, we concluded that as long as the customer's printed circuit board characteristics are reasonably close to these parameters there should not be any issues relating to telecom compliance. In addition to a recommended external fuse, the modem module also has a Sidactor on board.

Multi-Tech believes that, provided the same components are used and parts placement is similar, Telecom compliance will be maintained for the system and no additional testing is required.

### **Calculating Z for Tip and Ring Traces**

Trace Impedance - Side-by-Side Traces

$$Z_o = \frac{120}{\sqrt{E_r}} \times \ln \left( \frac{\pi s}{w + t} \right)$$

Where:  $E_r$  = Relative permittivity of the PCB dielectric material. Typically 4 - 4.7

$s$  = Spacing between traces - 12 mils (.012)

$w$  = Trace width - 12 mils (.012)

$t$  = Trace thickness - (.0022)

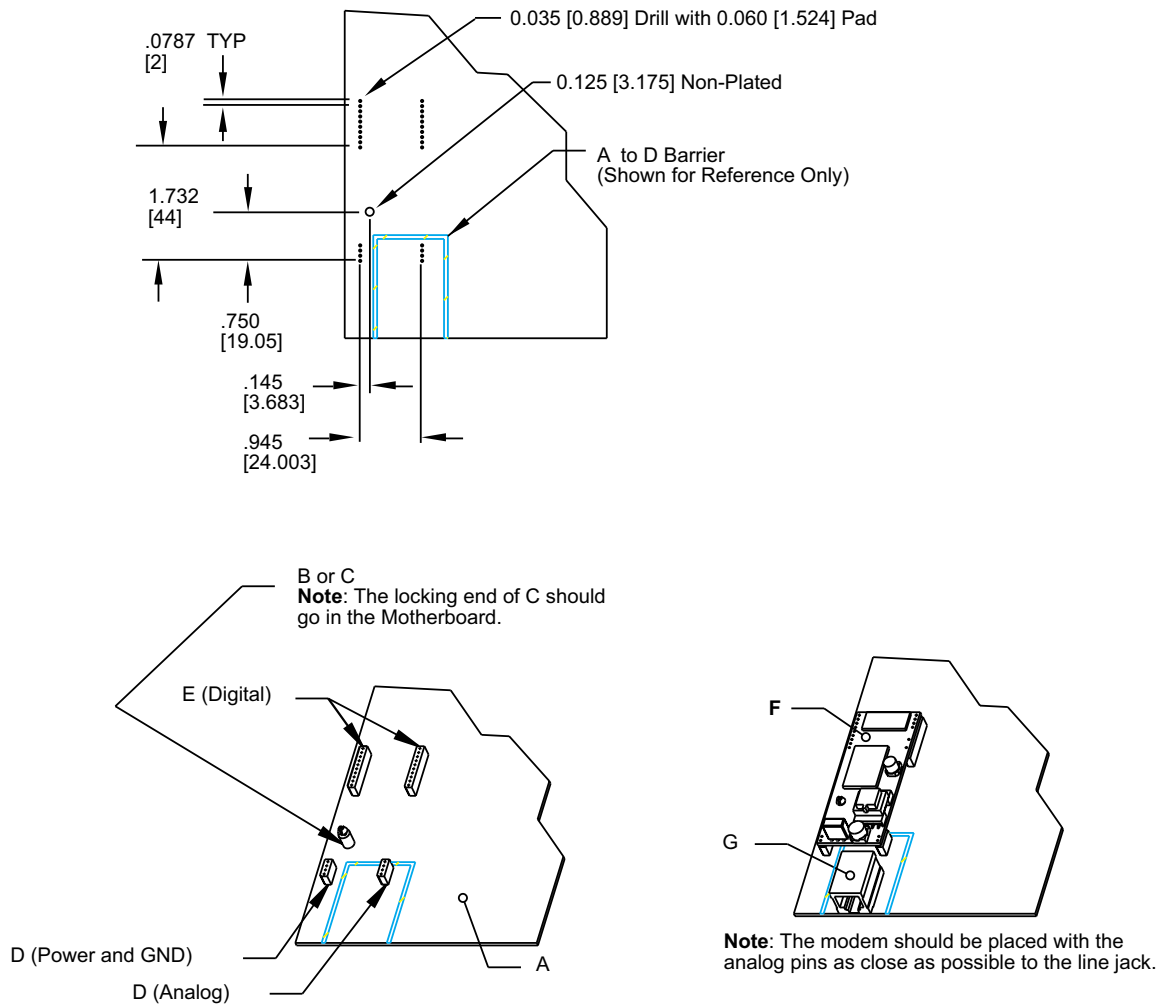
$$Z_o = \frac{120}{2.16} \times \ln \left( \frac{.03769}{.0142} \right)$$

$$Z_o = 54 \Omega$$

**Note:** The trace inductance for the tested design varied from 61nH to 105nH.

## MT3334SMI Placement

Figure 1-8 illustrates where to place the MT3334SMI on a typical Motherboard. It must be placed so that the analog end is near the phone jack.



**Figure 1-8: Placing the MT3334 SMI on a Typical Circuit Board**

**Key:**

<u>Qty</u>	<u>Ref</u>	<u>Name</u>	<u>Description</u>
1	A	Reference	Generic Motherboard
1	B or C	Recommended	RICHO DLMS-4-01 Support Post
1	C or B	Recommended	RICHO MSP-4-01 Support Post
2	D	Recommended	4-Pin 2mm SIP Socket (Thomas & Betts 42J2-04)
2	E	Recommended	10-Pin 2mm SIP Socket (Thomas & Betts 42J2-10)
1	F	Reference	Socket Modem Assembly
1	G	Reference	Line Jack



## Telecom Labeling Requirements

FCC regulations require labeling of registered Telephone and Data Terminal Equipment in accordance with Part 68 Subpart D. There are two options available for labeling of the device containing the MT5634SM modem module. The first option would be to use the registration number assigned to Multi-Tech Systems, Inc. by the FCC as explained in Section 68.300 below and shown in the sample label. The second option would be for the customer to submit applications for and use their own registration number that would be assigned by the FCC. This would require a letter of authorization for reregistration written by Multi-Tech Systems, Inc. giving the customer permission to reregister the product. The customer would also need to obtain and file the necessary documents and pay the required fees to the FCC.

Similarly, Industry Canada requires labeling in accordance with CS-03 requirements. Each modem module includes an Industry Canada label that should be attached to the final product as described in the Industry Canada CS-03 section below. Multiple Listing (similar to FCC's re-registration) is also an option for Industry Canada labeling. Instructions are also detailed below.

### FCC Part 68

(From FCC PART 68 Subpart D—Conditions for Registration)

Complete document available from US Government Printing Office:

<http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=199847>

Section 68.300 Labeling requirements.

- (a) Registered terminal equipment and registered protective circuitry shall have prominently displayed on an outside surface the following information in the following format:

Complies With Part 68, FCC Rules  
 FCC Registration Number: \_\_\_\_\_  
 Ringer Equivalence: \_\_\_\_\_

- (b) Registered terminal equipment and registered protective circuitry shall also have the following identifying information permanently affixed to it.
- (1) Grantee's name.
  - (2) Model number, as specified in the registration application.
  - (3) Serial number or date of manufacture.
  - (4) Country of origin of the equipment: "Made in \_\_\_\_\_."  
 Required if the equipment is not manufactured in the United States. (Country of origin shall be determined in accordance with 19 U.S.C. 1304 and regulations promulgated thereunder.)
  - (5) As used herein, permanently affixed means that the required nameplate data is etched, engraved, stamped, indelibly printed or otherwise permanently marked. Alternatively, the required information may be permanently marked on a nameplate of metal, plastic, or other material fastened to the enclosure by welding, riveting, or with a permanent adhesive. Such a nameplate must be able to last for the expected lifetime of the equipment and must not be readily detachable.
  - (6) When the device is so small or for such use that it is not practical to place the statements specified in this section on it, the information required by paragraphs (a) and (b) of this section shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user. The FCC Registration Number and the Model Number shall be displayed on the device.

Sample:

<p><b>Complies With Part 68, FCC Rules</b>  <b>FCC Registration Number:</b>  <b>AU7USA-25814-M5-5</b>  <b>Ringer Equivalence</b>  <b>Multi-Tech Systems, Inc.</b>  <b>Model MT5634SM</b>  <b>S/N: xxxxxxx</b></p>
---

## **Reregistration**

(From Form 730 Application Guide Appendix C-2) <http://www.fcc.gov/formpage.html>

Private label distributors may obtain a registration number in their own name. In this case, a reregistration filing is made with the submission of Exhibit B, a copy of a letter from the original registrant to the applicant giving permission for the reregistration and a willingness to provide the applicant with any technical support. The applicant will replace the registration label on the original grantee with the one containing the newly assigned registration number.

## **Industry Canada CS-03**

Canadian regulations require that certified equipment bear an identifying certification label which is obtained from Industry Canada. The label provided must be displayed on the equipment according to Industry Canada specifications. <http://spectrum.ic.gc.ca/~cert/>

From Certification Procedure 01 (CP-01):

Certified equipment will bear an identifying certification label and the certificate holder will be responsible for permanently affixing this certification label. The certification label identifies certified equipment to the public, representatives of the telecommunications common carriers, the Department, and other interested parties. The label must be permanently affixed to the equipment.

## **Multiple Listing**

This terminal device may be multiple listed to other distributors based upon the approval granted to the original certificate holder. In order to obtain a multiple listing certification, the following documentation must be presented to Industry Canada:

- (a) The model number, Industry Canada certificate number and certification number of the approved equipment;
- (b) a letter from the original certificate holder authorizing the Department to use information on file to grant a multiple listing certification. The name / model number, certificate number and certification number for the subject equipment must be shown. The letter must also declare that the model to be multiple listed is identical in design and construction to the originally approved model;
- (c) a letter, from the proposed multiple listee, requesting the certification;
- (d) a Terminal Equipment Certification / Testing Application and Agreement form, completed by the proposed multiple listee;
- (e) a drawing, sample or illustration of the product label; and
- (f) payment in accordance with TRC-49 section on Multiple Listings.

---

# Modem *Module*

## Chapter 2 - AT Commands, S-Registers, and Result Codes

## Introduction

The AT commands are used to control the operation of your modem. They are called *AT* commands because each command must be preceded by the characters *AT* to get the *AT*tention of the modem.

AT commands can be issued only when the modem is in command mode or online command mode. The modem is in *command mode* whenever it is not connected to another modem. The modem is in *data mode* whenever it is connected to another modem and ready to exchange data. *Online command mode* is a temporary state in which you can issue commands to the modem while connected to another modem. To put the modem into online command mode from data mode, you must issue an *escape sequence* (+++) followed immediately by the *AT* characters and the command, e.g., +++ATH to hang up the modem. To return to data mode from online command mode, you must issue the command ATO.

To send AT commands to the modem you must use a communications program, such as the HyperTerminal applet in Windows 98/95 and NT 4.0, or some other available terminal program. You can issue commands to the modem either directly, by typing them in the terminal window of the communications program, or indirectly, by configuring the operating system or communications program to send the commands automatically. Fortunately, communications programs make daily operation of modems effortless by hiding the commands from the user. Most users, therefore, need to use AT commands only when reconfiguring the modem, e.g., to turn autoanswer on or off.

The format for entering an AT command is **ATXn**, where *X* is the command and *n* is the specific value for the command, sometimes called the command *parameter*. The value is always a number. If the value is zero, you can omit it from the command; thus, **AT&W** is equivalent to **AT&W0**. Most commands have a *default* value, which is the value that is set at the factory. The default values are shown in the "AT Command Summary" (See below).

You must press ENTER (depending on the terminal program it could be some other key) to send the command to the modem. Any time the modem receives a command, it sends a response known as a *result code*. The most common result codes are *OK*, *ERROR*, and the *CONNECT* messages that the modem sends to the computer when it is connecting to another modem. For a table of valid result codes, see "Result Codes" at the end of this chapter.

You can issue several commands in one line, in what is called a command *string*. The command string begins with **AT** and ends when you press ENTER. Spaces to separate the commands are optional; they are ignored by the command interpreter. The most familiar command string is the *initialization string*, which is used to configure the modem when it is turned on or reset, or when your communications software calls another modem.

### AT Command Summary

Command: AT	<b>Attention Code</b>
Values:	n/a
Description:	The attention code precedes all command lines except <b>A/</b> , <b>A:</b> , and escape sequences.
Command:	ENTER Key
Values:	n/a
Description:	Press the ENTER (RETURN) key to execute most commands.
Command: A	<b>Answer</b>
Values:	n/a
Description:	Answer call before final ring.
Command: A/	<b>Repeat Last Command</b>
Values:	n/a
Description:	Repeat the last command string. Do not precede this command with <b>AT</b> . Do not press ENTER to execute.

---

Command:	<b>Bn</b>	<b>Communication Standard Setting</b>
Values:	$n = 0-3, 15, 16$	
Default:	1 and 16	
Description:	B0	Select ITU-T V.22 mode when modem is at 1200 bps.
	B1	Select Bell 212A when modem is at 1200 bps.
	B2	Deselect V.23 reverse channel (same as <b>B3</b> ).
	B3	Deselect V.23 reverse channel (same as <b>B2</b> ).
	B15	Select V.21 when the modem is at 300 bps.
	B16	Select Bell 103J when the modem is at 300 bps.
Command:	<b>Ds</b>	<b>Dial</b>
Values:	$s =$ dial string (phone number and dial modifiers)	
Default:	none	
Description:	Dial telephone number $s$ , where $s$ may up to 40 characters long and include the 0–9, *, #, A, B, C, and D characters, and the <b>L, P, T, V, W, S</b> , comma (,), semicolon (;), !, @, ^ and \$ dial string modifiers.	
	<i>Dial string modifiers:</i>	
	<b>L</b> Redial last number. (Must be placed immediately after <b>ATD</b> .)	
	<b>P</b> Pulse-dial following numbers in command.	
	<b>T</b> Tone-dial following numbers in command (default).	
	<b>V</b> Switch to speakerphone mode and dial the following number. Use <b>ATH</b> command to hang up.	
	<b>W</b> Wait for a new dial tone before continuing to dial. ( <b>X2, X4, X5, X6, or X7</b> must be selected.)	
	,	Pause during dialing for time set in register S8.
	;	Return to command mode after dialing. (Place at end of dial string.)
	!	Hook flash. Causes the modem to go on-hook for one-half second, then off-hook again.
	@	Wait for quiet answer. Causes modem to wait for a ringback, then 5 seconds of silence, before processing next part of command. If silence is not detected, the modem returns a NO ANSWER code.
	^	Disable data calling tone transmission.
	\$	Detect AT&T call card “bong” tone. The character should follow the phone number and precede the user’s call card number: <b>ATDT1028806127853500\$123456789</b>
Command:	<b>DS=y</b>	<b>Dial Stored Telephone Number</b>
Values:	$n = 0-3$	
Default:	none	
Description:	Dial a number previously stored in directory number $y$ by the <b>&amp;Zy=x</b> command. Example: <b>ATDS=3</b>	
Command:	<b>En</b>	<b>Echo Command Mode Characters</b>
Values:	$n = 0$ or 1	
Default:	1	
Description:	E0	Do not echo keyboard input to the terminal.
	E1	Do echo keyboard input to the terminal.
Command:	<b>Fn</b>	<b>Echo Online Data Characters</b>
Values:	$n = 1$	
Default:	1	
Description:	F0	Enable online data character echo. (Not supported.)
	F1	Disable online data character echo (included for backward compatibility with some software).
Command:	<b>Hn</b>	<b>Hook Control</b>
Values:	$n = 0$ or 1	
Default:	0	
Description:	H0	Go on-hook (hang up).
	H1	Go off-hook (make the phone line busy).

**Command: In Information Request**

Values:  $n = 0-5, 9, 11$

Default: None

Description: I0 Display default speed and controller firmware version.  
I1 Calculate and display ROM checksum (e.g., 12AB).  
I2 Check ROM and verify the checksum, displaying *OK* or *ERROR*.  
I3 Display default speed and controller firmware version.  
I4 Display firmware version for data pump (e.g., 94).  
I5 Display the board ID: software version, hardware version, and country ID  
I9 Display the country code (e.g., *NA Ver. 1*).  
I11 Display diagnostic information for the last modem connection, such as DSP and firmware version, link type, line speed, serial speed, type of error correction/data compression, number of past retrains, etc.

**Command: Ln Monitor Speaker Volume**

Values:  $n = 0, 1, 2, \text{ or } 3$

Default: 2

Description: L0 Select low volume.  
L1 Select low volume.  
L2 Select medium volume.  
L3 Select high volume.

**Command: Mn Monitor Speaker Mode**

Values:  $n = 0, 1, 2, \text{ or } 3$

Default: 1

Description: M0 Speaker always off.  
M1 Speaker on until carrier signal detected.  
M2 Speaker always on when modem is off-hook.  
M3 Speaker on until carrier is detected, except while dialing.

**Command: Nn Modulation Handshake**

Values:  $n = 0 \text{ or } 1$

Default: 1

Description: N0 Modem performs handshake only at communication standard specified by **S37** and the **B** command.  
N1 Modem begins handshake at communication standard specified by **S37** and the **B** command. During handshake, fallback to a lower speed can occur.

**Command: On Return Online to Data Mode**

Values: 0, 1, 3

Default: None

Description: O0 Exit online command mode and return to data mode (see **+++AT<CR>** escape sequence ).  
O1 Issue a retrain and return to online data mode.  
O3 Issue a rate renegotiation and return to data mode.

**Command: P Pulse Dialing**

Values: P, T

Default: T

Description: Configures the modem for pulse (non-touch-tone) dialing. Dialed digits are pulsed until a **T** command or dial modifier is received.

**Command: Qn Result Codes Enable/Disable**

Values:  $n = 0 \text{ or } 1$

Default: 0

Description: Q0 Enable result codes.  
Q1 Disable result codes.  
Q2 Returns an *OK* for backward compatibility with some software.

**Command: Sr=n Set Register Value**

Values:  $r = \text{S-register number}; n \text{ varies}$

Default: None

Description: Set value of register  $Sr$  to value of  $n$ , where  $n$  is entered in decimal format. E.g., **S0=1**.

---

Command:	<b>Sr?</b>	<b>Read Register Value</b>
Values:		$r =$ S-register number
Default:		None
Description:		Read value of register $Sr$ and display it in 3-digit decimal form. E.g., <b>S2?</b> gives the response <i>043</i> .
Command:	<b>T</b>	<b>Tone Dialing</b>
Values:		P, T
Default:		T
Description:		Configures the modem for DTMF (touch-tone) dialing. Dialed digits are tone dialed until a <b>P</b> command or dial modifier is received.
Command:	<b>Vn</b>	<b>Result Code Format</b>
Values:		$n = 0$ or $1$
Default:		1
Description:	V0	Displays result codes as digits (terse response).
	V1	Displays result codes as words (verbose response).
Command:	<b>Wn</b>	<b>Result Code Options</b>
Values:		$n = 0, 1,$ or $2$
Default:		2
Description:	W0	CONNECT result code reports serial port speed, disables protocol result codes.
	W1	CONNECT result code reports serial port speed, enables protocol result codes.
	W2	CONNECT result code reports line speed, enables protocol result codes.
Command:	<b>Xn</b>	<b>Result Code Selection</b>
Values:		$n = 0-7$
Default:		4
Description:	X0	Basic result codes (e.g., <i>CONNECT</i> ); does not look for dial tone or busy signal.
	X1	Extended result codes (e.g., <i>CONNECT 46000 V42bis</i> ); does not look for dial tone or busy signal.
	X2	Extended result codes with <i>NO DIALTONE</i> ; does not look for busy signal.
	X3	Extended result codes with <i>BUSY</i> ; does not look for dial tone.
	X4	Extended result codes with <i>NO DIALTONE</i> and <i>BUSY</i> .
	X5	Extended result codes with <i>NO DIALTONE</i> and <i>BUSY</i> .
	X6	Extended result codes with <i>NO DIALTONE</i> and <i>BUSY</i> .
	X7	Basic result codes with <i>NO DIALTONE</i> and <i>BUSY</i> .
Command:	<b>Zn</b>	<b>Modem Reset</b>
Values:		$n = 0$ or $1$
Default:		None
Description:	Z0	Reset modem to profile saved by the last <b>&amp;W</b> command.
	Z1	Same as <b>Z0</b> .
Command:	<b>&amp;Cn</b>	<b>Data Carrier Detect (DCD) Control</b>
Values:		$n = 0$ or $1$
Default:		1
Description:	&C0	Forces the DCD circuit to be always high.
	&C1	DCD goes high when the remote modem's carrier signal is detected, and goes low when the carrier signal is not detected.
Command:	<b>&amp;Dn</b>	<b>Data Terminal Ready (DTR) Control</b>
Values:		$n = 0, 1, 2,$ or $3$
Default:		2
Description:	&D0	Modem ignores the true status of the DTR signal and responds as if it is always on.
	&D1	If DTR drops while in online data mode, the modem enters command mode, issues an <i>OK</i> , and remains connected.
	&D2	If DTR drops while in online data mode, the modem hangs up. If the signal is not present, the modem will not answer or dial.
	&D3	If DTR drops, the modem hangs up and resets as if an <b>ATZ</b> command were issued.

---

Command: **&Fn Load Factory Settings**  
Values:  $n = 0$   
Default: None  
Description: &F0 Load factory settings as active configuration.

**Note:** See also the **Z** command.

Command: **&Gn V.22bis Guard Tone Control**  
Values:  $n = 0, 1, \text{ or } 2$   
Default: 0  
Description: &G0 Disable guard tone.  
&G1 Set guard tone to 550 Hz.  
&G2 Set guard tone to 1800 Hz.

**Note:** The **&G** command is not used in North America.

Command: **&Kn Flow Control Selection**  
Values:  $n = 0, 3, \text{ or } 4$   
Defaults: 3  
Description: &K0 Disable flow control.  
&K3 Enable CTS/RTS hardware flow control.  
&K4 Enable XON/XOFF software flow control.

Command: **&Pn Pulse Dial Make-to-Break Ratio Selection**  
Values:  $n = 0, 1, \text{ or } 2$   
Default: 0  
Description: &P0 60/40 make-to-break ratio  
&P1 67/33 make-to-break ratio  
&P2 20 pulses per second

**Note:** The **&P** command is used only in Japan.

Command: **&Qn Asynchronous Communications Mode**  
Values:  $n = 0, 5, 6, 8, \text{ or } 9$   
Default: 5  
Description: &Q0 Asynchronous with data buffering. Same as **W0**.  
&Q5 Error control with data buffering. Same as **W3**.  
&Q6 Asynchronous with data buffering. Same as **W0**.  
&Q8 MNP error control mode. If MNP error control is not established, the modem falls back according to the setting in **S36**.  
&Q9 V.42 or MNP error control mode. If neither error control is established, the modem falls back according to the setting in **S36**.

Command: **&Sn Data Set Ready (DSR) Control**  
Values:  $n = 0 \text{ or } 1$   
Default: 0  
Description: &S0 Force DSR always high (on).  
&S1 Let DSR go high only during a connection.  
at power-on or following the **ATZ** command.

Command: **&V Display Current Settings**  
Values: n/a  
Description: Displays the active modem settings, including the callback security settings if callback security is enabled. If the setup password has been entered, it also displays the callback security passwords.

Command: **&Wn Store Current Configuration**  
Values:  $n = 0$   
Default: 0  
Description: &W0 Stores current modem settings in non-volatile memory and causes them to be loaded at power-on or following the **ATZ** command instead of the factory defaults. See also the **&F** command.  
&W1 Clears user default settings from non-volatile memory and causes the factory defaults to be loaded at power-on or following the **ATZ** command.



**Command: &Zy=x Store Dialing Command**

Values:  $y = 0-3$  (callback security disabled) or  $0-29$  (callback security enabled)  
 $x =$  Dialing command

Default: None

Description: Stores dialing command  $x$  in memory location  $y$ . Dial the stored number using the command **ATDS=y**. See also the **#CBSn** command. For callback security options, see Chapter 6.

**Command: \An Select Maximum MNP Block Size**

Values:  $n = 0, 1, 2,$  or  $3$

Default: 3

Description: \A0 64-character maximum.  
 \A1 128-character maximum.  
 \A2 192-character maximum.  
 \A3 256-character maximum.

**Command: \Bn Transmit Break**

Values:  $n = 0-9$  in 100 ms units

Default: 3

Description: In non-error-correction mode only, sends a break signal of the specified length to a remote modem. Works in conjunction with the **\K** command.

**Command: \Jn Data Buffer Control**

Values:  $n = 0$

Default: 0

Description: \J0 Enable data buffer—serial port speed is independent of connect speed.  
 \J1 Disable data buffer—serial port speed is forced to the line speed.

**Command: \Kn Break Control**

Values:  $n = 0-5$

Default: 5

Description: Controls the response of the modem to a break received from the computer, the remote modem, or the **\B** command. The response is different for each of three different states.

**Data mode.** The modem receives the break from the computer:

\K0 Enter online command mode, no break sent to the remote modem.  
 \K1 Clear data buffers and send break to the remote modem.  
 \K2 Same as **\K0**.  
 \K3 Send break immediately to the remote modem.  
 \K4 Same as **\K0**.  
 \K5 Send break to the remote modem in sequence with the transmitted data.

**Data mode.** The modem receives the break from the remote modem:

\K0 Clear data buffers and send break to the computer.  
 \K1 Same as **\K0**.  
 \K2 Send break immediately to the computer.  
 \K3 Same as **\K2**.  
 \K4 Send break to the computer in sequence with the received data.  
 \K5 Same as **\K4**.

**Online command mode.** The modem receives a **\Bn** command from the computer:

\K0 Clear data buffers and send break to the remote modem.  
 \K1 Same as **\K0**.  
 \K2 Send break immediately to the remote modem.  
 \K3 Same as **\K2**.  
 \K4 Send break to the remote modem in sequence with the transmitted data.  
 \K5 Same as **\K4**.

**Command: \Nn Error Correction Mode Selection**

Values:  $n = 0-5$ , or 7

Default: 3

Description: \N0 Non-error correction mode with data buffering (buffer mode; same as **&Q6**).  
\N1 Direct mode.  
\N2 MNP reliable mode. If the modem cannot make an MNP connection, it disconnects.  
\N3 V.42/MNP auto-reliable mode. The modem attempts first to connect in V.42 error correction mode, then in MNP mode, and finally in non-error-correction (buffer) mode with continued operation.  
\N4 V.42 reliable mode. If the modem cannot make a V.42 connection, it disconnects.  
\N5 V.42, MNP, or non-error correction (same as **W3**).  
\N7 V.42, MNP, or non-error correction (same as **W3**).

**Command: \Qn Flow Control Selection**

Values:  $n = 0, 1$ , or 3

Default: 3

Description: \Q0 Disable flow control (same as **&K0**).  
\Q1 XON/XOFF software flow control (same as **&K4**).  
\Q2 CTS-only flow control. Not supported.  
\Q3 RTS/CTS hardware flow control (same as **&K3**).

**Command: \Tn Inactivity Timer**

Values:  $n = 0, 1-255$

Default: 0

Description: \Tn Sets the time (in minutes) after the last character is sent or received that the modem waits before disconnecting. A value of zero disables the timer. Applies only in buffer mode.

**Note:** You can also set the inactivity timer by changing the value of **S30**.

**Command: \Vn Protocol Result Code**

Values:  $n = 0, 1$ , or 2

Default: 1

Description: \V0 Disable the appending of the protocol result code to the DCE speed.  
\V1 Enable the appending of the protocol result code to the DCE speed.  
\V2 Same as **IV1**.

**Command: \Xn XON/XOFF Pass-Through**

Values:  $n = 0$  or 1

Defaults: 0

Description: \X0 Modem responds to and discards XON/XOFF characters.  
\X1 Modem responds to and passes XON/XOFF characters.

**Command: -Cn Data Calling Tone**

Values:  $n = 0$  or 1

Defaults: 0

Description: -C0 Disable V.25 data calling tone to deny remote data/fax/voice discrimination.  
-C1 Enable V.25 data calling tone to allow remote data/fax/voice discrimination.

**Command: %B View Numbers in Blacklist**

Values: n/a

Description: If blacklisting is in effect, **AT%B** displays the numbers for which the last call attempted in the previous two hours failed. In countries that do not require blacklisting, the *ERROR* result code appears.

**Command: %Cn Data Compression Control**

Values:  $n = 0$  or 1

Default: 1

Description: %C0 Disable V.42bis/MNP 5 data compression.  
%C1 Enable V.42bis/MNP 5 data compression.

**Command: %DCn AT Command Control**Values: *n* = 0 or 1

Default: 0

Description: %DC0 The modem responds to AT commands.  
%DC1 The modem ignores AT commands.**Note:** The modem will respond to **AT%DC** for 10 seconds after power-up.**Command: %En Fallback and Fall Forward Control**Values: *n* = 0, 1, or 2

Default: 2

Description: %E0 Disable fallback and fall forward.  
%E1 Enable fallback, disable fall forward.  
%E2 Enable fallback and fall forward.**Command: \$Dn DTR Dialing**Values: *n* = 0 or 1

Default: 0

Description: \$D0 Disables DTR dialing.  
\$D1 Dials the number in memory location 0 when DTR goes high.**Command: +ES=*n* Enable Synchronous Buffered Mode**Values: *n* = 6

Default: None

Description: Allows an H.324 video application direct access to the synchronous data channel. On underflow, the modem sends HDLC flag idle (0x7E) to the remote modem. This special error control mode is overridden by any of the following commands: **&F**, **&M**, **&Q**, or **W**.**AT+ES=?** shows the only allowed value.**AT+ES?** shows the current value.**Command: #Sx Enter Setup Password**Values: *x*= password (1–8 characters, case sensitive)

Default: MTSMODEM

Description: Enters the remote configuration setup password.

**Command: #S=*x* Store Setup Password**Values: *x*= password (1–8 characters, case sensitive)

Default: MTSMODEM

Description: Stores a new remote configuration setup password.

**Command: +++AT<CR> Escape Sequence**

Values: n/a

Description: Puts the modem in command mode (and optionally issues a command) while remaining online. Type **+++AT** and up to ten command characters, then press ENTER. Used mostly to issue the hang-up command: **+++ATH<CR>**.**Command: %%AT<CR>Remote Configuration Escape Sequence**

Values: n/a

Description: Initiates remote configuration mode while online with remote modem. The remote configuration escape character (%) is defined in register **S13**.

## S-Registers

Certain modem values, or parameters, are stored in memory locations called S-registers. Use the **S** command to read or to alter the contents of S-registers (see previous section).

<b>Register</b>	<b>Unit</b>	<b>Range</b>	<b>Default</b>	<b>Description</b>
<b>S0</b>	1 ring	0, 1–255	1	Sets the number of rings until the modem answers. <b>ATS0=0</b> disables autoanswer completely.
<b>S1</b>	1 ring	0–255	0	Counts the rings that have occurred.
<b>S2</b>	decimal	0–127 128–255	43 (+)	Sets ASCII code for the escape sequence character. Values greater than 127 disable escape.
<b>S3</b>	decimal	0–127	13 (^M)	Sets the ASCII code for the carriage return character.
<b>S4</b>	decimal	0–127	10 (^J)	Sets the ASCII code for the line feed character.
<b>S5</b>	decimal	0–32 33–127	8 (^H)	Sets the ASCII code for the backspace character. Values greater than 32 disable backspace.
<b>S6</b>	seconds	2–65*	2*	Sets the time the modem waits after it goes off-hook before it begins to dial the telephone number.
<b>S7</b>	seconds	1–255*	50*	Sets the time the modem waits for a carrier signal before aborting a call. Also sets the wait for silence time for the @ dial modifier.
<b>S8</b>	seconds	0–65	2	Sets the length of a pause caused by a comma character in a dialing command.
<b>S9</b>	decimal	0, 1–127	37 (%)	Sets ASCII code for remote configuration escape character. <b>S9=0</b> disables remote configuration.
<b>S10</b>	100 ms	1–254	20	Sets how long a carrier signal must be lost before the modem disconnects.
<b>S11</b>	1 ms	50–150*	95*	Sets spacing and duration of dialing tones.
<b>S28</b>	decimal	0, 1–255	1	0 disables, 1–255 enables V.34 modulation.
<b>S30</b>	1 minute	0, 1–255	0	Sets the length of time that the modem waits before disconnecting when no data is sent or received. A value of zero disables the timer. See also the <b>IT</b> command
<b>S35</b>	decimal	0–1	0	0 disables, 1 enables the V.25 data calling tone, which allows remote data/fax/voice discrimination.
<b>S36</b>	decimal	0–7	7	Specifies the action to take in the event of a negotiation failure when error control is selected. (See <b>S48</b> .)
<b>S37</b>	decimal	0–19	0	Sets the maximum V.34 “upstream” speed at which the modem attempts to connect. 0 = maximum modem speed 1 = reserved 2 = 1200/75 bps 3 = 300 bps 4 = reserved 5 = 1200 bps 6 = 2400 bps 7 = 4800 bps 8 = 7200 bps 9 = 9600 bps 10 = 12000 bps 11 = 14400 bps 12 = 16800 bps 13 = 19200 bps 14 = 21600 bps 15 = 24000 bps 16 = 26400 bps 17 = 28800 bps 18 = 31200 bps 19 = 33600 bps

**S43** decimal 0–1 1

*For testing and debugging only.* Enables/disables V.32bis start-up auto mode operation. 0 = disable; 1 = enable.

**S48** decimal 7 or 128 7

Enables (7) or disables (128) LAPM negotiation. The following table lists the **S36** and **S48** configuration settings for certain types of connections.

	S48=7	S48=128
S36=0, 2	LAPM or hangup	Do not use
S36=1, 3	LAPM or async	Async
S36=4, 6	LAPM, MNP, or hangup	MNP or hangup
S36=5, 7	LAPM, MNP, or aysnc	MNP or async

**S89** seconds 0, 5–255 10

Sets the length of time in the off-line command mode before the modem goes into standby mode. A value of zero prevents standby mode; a value of 1–4 sets the value to 5.

## Result Codes

In command mode your modem can send responses called *result codes* to your computer. Result codes are used by communications programs and can also appear on your monitor.

<u>Terse</u>	<u>Verbose</u>	<u>Description</u>
0	OK	Command executed
1	CONNECT	Modem connected to line
2	RING	Ring signal detected
3	NO CARRIER	Carrier signal lost or not detected
4	ERROR	Invalid command
5 *	CONNECT 1200	Connected at 1200 bps
6	NO DIALTONE	No dial tone detected
7	BUSY	Busy signal detected
8	NO ANSWER	No answer at remote end
10*	CONNECT 2400	Connected at 2400 bps
11*	CONNECT 4800	Connected at 4800 bps
12*	CONNECT 9600	Connected at 9600 bps
13*	CONNECT 14400	Connected at 14400 bps
14*	CONNECT 19200	Connected at 19200 bps
24*	CONNECT 7200	Connected at 7200 bps
25*	CONNECT 12000	Connected at 12000 bps
26*	CONNECT 16800	Connected at 16800 bps
40*	CONNECT 300	Connected at 300 bps
55*	CONNECT 21600	Connected at 21600 bps
56*	CONNECT 24000	Connected at 24000 bps
57*	CONNECT 26400	Connected at 26400 bps
58*	CONNECT 28800	Connected at 28800 bps
59*	CONNECT 31200	Connected at 31200 bps
60*	CONNECT 33600	Connected at 33600 bps
88	DELAYED	Delay is in effect for the dialed number
89	BLACKLISTED	Dialed number is blacklisted
90	BLACKLIST FULL	Blacklist is full

\* *EC* is added to these result codes when the extended result codes configuration option is enabled. *EC* is replaced by one of the following

codes, depending on the type of error control connection:

*V42bis* —V.42 error control (LAP-M) and V.42bis data compression

*V42* —V.42 error control (LAP-M) only

*MNP5* —MNP 4 error control and MNP 5 data compression

*MNP4* —MNP 4 error control only

*NoEC* —No error control protocol).

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# Modem *Module*

## Chapter 3 - Class 1 Fax Commands

## Introduction

The Service Class 1 standard (EIA/TIA-578) defines the commands that a PC user may issue to configure and control a fax/data modem, and the responses (result codes) that the fax/data modem may issue in response to those commands.

The Class 1 standard provides the basic services needed to support Group 3 fax operation. Support of the 1988 CCITT (ITU-T) T.30 recommended procedures for session management and the T.4 recommendation for image data handling are required at the PC.

Service Class 1 provides the following services (as required, or optional in Group 3 facsimile operation):

- Connection (originate and answer),
- Waiting and silence detection,
- Data transmission and reception (data transfer),
- HDLC (High-level Data Link Control) data framing/transparency/error detection, and
- Message generation/response.

HDLC is an ISO standard, bit-oriented data communications protocol. HDLC control information is consistently placed, and specific control bit patterns are considerably different than those used as data, providing a largely error-free protocol.

## Class 1 Fax Command Summary

The ModemModule Fax Class 1 enhancements are implemented with six **AT+F** (for Fax) commands. The **+FTM**, **+FRM**, **+FTH**, and **+FRH** commands must be entered as the last command in the command string (i.e., the last command on the command line). The **+FTS** and the **+FRS** commands can be entered anywhere in the command string.

<u>Command</u>	<u>Description</u>
<b>+FCLASS?</b>	Display Current Class
<b>+FCLASS=?</b>	Display Service Class Capabilities
<b>+FCLASS=&lt;n&gt;</b>	Select Service Class
<b>+FTS=&lt;time&gt;</b>	Stop transmission and pause (10 ms intervals, 0-255)
<b>+FTS=?</b>	Display the valid <b>+FTS=&lt;time&gt;</b> range (0-255)
<b>+FRS=&lt;time&gt;</b>	Wait for silence (10 ms intervals, 0-255)
<b>+FRS=?</b>	Display the valid <b>+FRS=&lt;time&gt;</b> range
<b>+FTM=&lt;MOD&gt;</b>	Transmit data with specified <MOD> carrier
<b>+FTM=?</b>	Display the valid <b>+FTM=&lt;MOD&gt;</b> carrier range
<b>+FRM=&lt;MOD&gt;</b>	Receive data with specified <MOD> carrier
<b>+FRM=?</b>	Display the valid <b>+FRM=&lt;MOD&gt;</b> carrier range
<b>+FTH=&lt;MOD&gt;</b>	Transmit HDLC data with specified <MOD> carrier
<b>+FTH=?</b>	Display the valid <b>+FTH=&lt;MOD&gt;</b> carrier range
<b>+FRH=&lt;MOD&gt;</b>	Receive HDLC data with specified <MOD> carrier
<b>+FRH=?</b>	Display the valid <b>+FRH=&lt;MOD&gt;</b> carrier range

If entering multiple commands on the command line, use semicolons between commands. These **+F** commands are defined in the following sections. The <MOD> parameter may take on the following values.



Table 3-1. Fax MOD (Modulation) Parameter Values

<u>Value</u>	<u>Modulation</u>	<u>Speed (bps)</u>	<u>Requirements</u>
3	V.21 ch.2	300	required for +FTH & +FRH
24	V.27ter	2400	required for +FTM & +FRM
48	V.27ter	4800	required for +FTM & +FRM
72	V.29	7200	optional
73	V.17	7200	optional
74	V.17 w/st	7200	optional
96	V.29	9600	optional
97	V.17	14400	optional
98	V.17 w/st	14400	optional
121	V.17 or V.33	12000	optional
122	V.17 w/st	12000	optional
145	V.17 or V.33	14400	optional
146	V.17 w/st	14400	optional

All other codes are reserved. "V.17 w/st" indicates V.17 short training (aka, "quick train"). All of the above commands return an *ERROR* result code if entered when the ModemModule is on-hook.

Use the command syntax **+<command>=?** to ask for the valid range of values supported. For example, if you entered **+FTH=?**, the Class 1 ModemModule would return 3 (a Class 2 ModemModule would return 3,24,48,72,73, 74, 96).

**Command:** **+FCLASS? <Enter>**

**Function:** Display Current Class

**Values:** 0, 1, 2

**Default:** 0 (data modem)

**Result Codes:** *OK* if the command is accepted; *ERROR* if the parameter value is out of range.

**Description:** **+FCLASS?** requests the current Service Class of the ModemModule, as shown below.

**Result Code    Meaning**

0            indicates a data modem

1            indicates a Service Class 1 (fax/data) modem

2            indicates a non-standard Class 2 modem (based on an early draft of the Class 2.0 standard).

**Command:** **+FCLASS=? <Enter>**

**Function:** Display Service Class Capabilities

**Values:** 0, 1 (other values are reserved)

**Default:** 0 (data modem)

**Result Codes:** *OK* if the command is accepted; *ERROR* if the parameter value is out of range.

**Description:** The **+FCLASS=?** command displays the set of Service Classes supported by the modem from the list of values (e.g., 0,1 for a modem that supports data communications plus fax Service Class 1). This command returns the service class or classes available with the modem. The modem returns a list of all supported values, separated by commas if more than one class is supported. For example, a modem that supports data communications and Class 1 fax would respond with "0,1".

**Command:** **+FCLASS=<value> <Enter>**  
**Function:** Select Service Class  
**Values:** 0, 1, 2  
**Default:** 0 (data mode)  
**Result Codes:** *OK* if the command is accepted; *ERROR* if the parameter value is out of range.  
**Description:** This command configures the Service Class for the modem.

The command options are:

**+FCLASS=0** Select Data mode  
**+FCLASS=1** Select Fax Class 1 operation  
**+FCLASS=2** Select Fax Class 2 operation

**Example:** To configure the modem for Class 1 fax operation, enter the command **AT+FCLASS=1** and hit Enter. The modem will then accept Class 1 commands.

**Command:** **+FTS=<time> <Enter>**  
**Function:** Stop Transmission and Wait  
**Values:** **<time>** = 0-255 in 10 ms intervals  
**Default:** 0  
**Result Codes:** *OK* if the command is accepted; *ERROR* if the parameter value is out of range.  
**Description:** The **+FTS=** command causes the modem to stop any transmission, then wait for the amount of time specified by **<time>**, then send an *OK* result code to the PC. If this command is entered with the modem on-hook, the *ERROR* result code is displayed. The main function of **+FTS** is to enforce the 75+/-20 ms of silent time needed between modulation changes.

**Note:** The **+FTS=** command can be entered anywhere in the command string.

**Command:** **+FTS=? <Enter>**  
**Function:** Display the wait-for-silent time range  
**Values:** **<time>** = 0-255 in 10 ms intervals  
**Default:** 0  
**Result Codes:** the current range of values supported by the modem.  
**Description:** The **+FTS=?** command causes the modem to display the valid (supported) range of time intervals specified by the **+FTS=<time>** command.

**Command:** **+FRS=<time> <Enter>**  
**Function:** Stop Transmission and Wait  
**Values:** **<time>** = 0-255 in 10 ms intervals  
**Default:** 0  
**Result Codes:** *OK* if the command is accepted; *ERROR* if the parameter value is out of range.  
**Description:** The **+FRS=** command causes the modem to listen for a specified amount of silence on the line, then display an *OK* result code when silence has been present on the line for the amount of time specified. The value **<time>** is in 10 millisecond intervals. The command terminates when either the specified amount of silent time has been detected, or when the PC sends the modem another character (which is discarded). The modem returns the *OK* result code in either case. If this command is entered with the modem on-hook, the *ERROR* result code is displayed. The main function of the **+FRS=** command is to determine when it is safe to reverse the line and start transmitting.

**Note:** The **+FRS=** command can be entered anywhere in the command string.

**Command:** **+FRS=? <Enter>**  
**Function:** Display the range of stop-transmission-and-wait period values  
**Values:** **<time>** = 0-255 in 10 ms intervals  
**Default:** 0  
**Result Codes:** the current range of values supported by the modem.  
**Description:** The **+FRS=?** command causes the modem to display the current set of stop-transmission-and-wait period values supported (specified by the **+FRS=<time>** command).

**Command:** **+FTM=<MOD> <Enter>**  
**Function:** Transmit data with <MOD> carrier  
**Values:** **<MOD>** = 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** *CONNECT* at start of training pattern transmission; *ERROR* if the parameter value is out of range.  
**Description:** The **+FTM** command causes the PC to transmit data using the fax modulation specified in <MOD> (see Table 3-1 for values). The modem displays the *CONNECT* result code, then transmits the proper training sequence in the selected mode, followed by constant 1 bits until data is received from the PC. The modem buffers data in this mode, using the flow control method defined by the **&E** command. When the modem's transmit buffer is emptied, and if the last character transmitted was not a NUL, the modem turns off transmit carrier, returns to Command mode, and displays the *OK* result code.

**Note:** The **+FTM=** command must be entered as the last command in the command string (i.e., it must be followed by the <Enter> key).

**Command:** **+FTM? <Enter>**  
**Function:** Display the range of valid transmit data modulation values  
**Values:** **<MOD>** = 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** the current value supported by the modem.  
**Description:** The **+FTM?** command causes the modem to display the current set of accepted modulation for transmit data values (specified by the **+FTM=<MOD>** command).

**Command:** **+FRM=<MOD> <Enter>**  
**Function:** Facsimile Receive with <MOD> carrier  
**Values:** see Table 3-1 for <MOD> (modulation) values  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** *CONNECT*, *NO CARRIER*, or *+FCERROR*  
**Description:** The **+FRM=** command causes the modem to enter fax receive mode using the modulation specified by <MOD> (refer to Table 3-1 for <MOD> values). The modem returns to Command mode on loss of carrier, then displays the *NO CARRIER* result code on the PC. When the modem detects the selected carrier, it sends the *CONNECT* message. If a different signal is detected, a *+FCERROR* (Connect Error) is displayed, and the modem returns to Command mode. The modem uses the flow control method defined by the **&E** command. If the PC sends any character except DC1 or DC3, the modem enters Command mode, and causes the PC to display the *OK* result code. If this command is entered with the modem on-hook, the *ERROR* result code is displayed.

**Note:** The **+FRM=** command must be entered as the last command in the command string (i.e., it must be immediately followed by the <Enter> key).

**Command:** **+FRM=? <Enter>**  
**Function:** Display the valid range of receive data modulation values  
**Values:** **<MOD>** = 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** the current value range supported by the modem.  
**Description:** The **+FRM=?** command causes the modem to display the current modulation for receive data specified by the **+FRM=<MOD>** command.

**Command:** **+FTH=<MOD> <Enter>**  
**Function:** Transmit HDLC data with **<MOD>** carrier  
**Values:** see Table 3-1 for **<MOD>** (modulation) values  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** *OK, ERROR, or CONNECT*  
**Description:** The **+FTH** command causes the modem to transmit data in HDLC protocol using the selected modulation (see Table 3-1 for modulation **<MOD>** values). The modem buffers data in HDLC transmit mode, using the configured method of flow control to pause PC data, as necessary. If the PC sends no data for 5 seconds after the *CONNECT* message, the modem turns off its transmit carrier, returns to Command mode, and displays the *OK* message.

**Note:** The **+FTH** command must be entered as the last command in the command string (i.e., it must be immediately followed by the **<Enter>** key).

**Command:** **+FTH=? <Enter>**  
**Function:** Displays the valid range of transmit modulation values  
**Values:** **<MOD>** = 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** the current range of valid values supported by the modem.  
**Description:** The **+FTH=?** command causes the modem to display the set of supported transmit modulations specified by the **+FTH=<MOD>** command (refer to Table 3-1).

**Command:** **+FRH=<MOD> <Enter>**  
**Function:** Receive HDLC data with **<MOD>** carrier  
**Values:** see Table 3-1 for **<MOD>** (modulation) values  
**Default:** 3 (V.21 ch.2 @ 300 bps)  
**Result Codes:** *NO CARRIER, +FCERROR, OK, or ERROR*  
**Description:** The **+FRH** command causes the modem to receive HDLC packet data using the modulation mode selected with **<MOD>**, then delivers the next frame to the PC. Possible **<MOD>** values are shown in Table 3-1. If other than an HDLC packet is detected, the modem displays the *+FCERROR* (Connect Error) message, returns to Command mode, then displays the *NO CARRIER* message. If this command is entered with the modem on-hook, the *ERROR* result code is displayed.

**Note:** The **+FRH** command must be entered as the last command in the command string (i.e., it must be immediately followed by the **<Enter>** key).

**Command:** **+FRH=? <Enter>**  
**Function:** Displays the valid range of receive modulation values  
**Values:** **<MOD>** = 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146  
**Default:** 3  
**Result Codes:** the valid range of values supported by the modem.  
**Description:** The **+FRH=?** command causes the modem to display the set of supported receive modulation values (specified by the **+FRH=<MOD>** command).

### Flow Control

XON/XOFF flow control is used by the ModemModule to match the PC-to-modem data rate to the line signaling rate. XON/XOFF flow control is mandatory and RTS/CTS flow control is optional per the Class 1 standard. There is currently no Class 1 command for setting the flow control method, and no means to read the current flow control method in use. The PC is responsible for matching the modem's default flow control method.

### Result Codes

Your Class 1 ModemModule can respond with the basic set of result codes (*OK*, *CONNECT*, *NO CARRIER*, and *ERROR*) with only minor differences in meaning for fax mode.

If the modem detects a data carrier or tone other than that specified by the **+FRM** or **+FRH** command, it sends a *CONNECT ERROR* (**+FCERROR**) result code to the PC, then returns to Command mode. This will allow the PC to recover by reconfiguring the modem to define the unexpected signal. The *CONNECT ERROR* message has the formats **+FCERROR** (verbose) or **+F4** (terse).

### Sample Sessions

This section provides Class 1 Fax send and receive handshaking examples.

**Table 3-2. Single-Page Class 1 Transmit Example**

<u>Command</u>	<u>Response</u>	<u>Action by Local Modem</u>	<u>Action by Remote PC</u>
AT+FCLASS=1 ATD<string>	OK	Set Class 1 Dial and send CNG Look for V.21 Detect flags	Answers Sends CED, V.21 Sends HDLC flags
	CONNECT <NSF frame> <DLE><ETX> OK	Detect flags Detect flags Get CSI	Send CSI packet Send NSF packet
AT+FRH=3	CONNECT Detect flags <CSI frame data> <DKE><ETX> OK	Get CSI Get FCS Accept FCS	Send CSI packet Check FCS
AT+FRH=3	CONNECT <DIS> frame data <DKE><ETX> OK	Detect flags Get DIS Get CRC Accept FCS Check FCS	Send DIS packet
AT+FRH=3	NO CARRIER	Detect loss of carrier	Drop carrier
AT+FTH=3	CONNECT	Send V.21 carrier Send flags Send TSI frame Send FCS	Detect carrier Detect flags Get TSI frame
<TSI frame data> <DLE><ETX>	CONNECT	Send flags Send DCS frame Send FCS, flags Drop carrier	Send DCS frame
<DCS frame data> <DLE><ETX>	OK		
AT+FTS=8; +FTM=96	CONNECT	Wait 80 msec Send V.29 carrier Send TCF data Drop carrier	Detect carrier Get TCF data
<TCF data pattern> <DLE><ETX>	OK		
AT+FRH=3	CONNECT <CFR frame data> <DLE><ETX> OK	Detect carrier Detect flags Get CFR frame Check FCS Accept FCS	Send V.21 carrier Send flags Send CFR frame Send CRC
AT+FRH=3	NO CARRIER	Detect loss of carrier	Drop carrier
AT+FTM=96 <page image data> <DLE><ETX>	CONNECT OK	Send V.29 carrier Send page data Drop carrier	Detect carrier Receive page
AT+FTS=8; +FTH=3	CONNECT	Wait 80 msec Send V.21 carrier Send flags Send EOP frame Send FCS Drop carrier	Detects carrier Detects flags Receives EOP (Final frame)
<EOP frame data> <DLE><ETX>	OK		
AT+FRH=3	CONNECT <MCF frame data> <DEL><ETX> OK	Detect carrier Detect flags Get MCF frame Check FCS Send FCS Accept FCS	Send V.21 carrier Send flags Send MCF frame
AT+FRH=3	NO CARRIER	Detect carrier loss	Drop carrier
AT+FTH=3	CONNECT	Send V.21 carrier Send flags Send DCN frame Send FCS Drop carrier	Detects carrier Detect flags Receives DCN
<DCN packet> <DLE><ETX>	OK		
ATH0	OK	Hang up	Hangup

Table 3-3. Single-Page Class 1 Answer &amp; Receive Example

<u>Command</u>	<u>Response</u>	<u>Action by Local Modem</u>	<u>Action by Remote PC</u>
AT+FCLASS=1	OK RING	Set Class to 1 Detect Ringing	Dial, send CNG
ATA	CONNECT	Offhook, Send CED, Send V.21 carrier Send flags	Get CED Detect carrier Detect flags
<CSIframe data> <DLE><ETX>	CONNECT	Send CSI data Send FCS Send flags	Receive FCS
<DISframe data> <DLE><ETX>	OK	Send DIS data Send FCS and flags Drop carrier	Receive DIS
AT+FRH=3	CONNECT <TSI frame data> <DLE><ETX> OK	Detect carrier Detect flags Receive TSI Receive FCS Accept FCS	Sends V.21 carrier Send flags Send TSI frame Send FCS
AT+FRH=3	CONNECT <DCS packet data> <DLER><ETX> OK	Receive DCS Receive FCS Accept FCS	Send DCS frame Send FCS
AT+FRH=3	NO CARRIER	Detect loss of carrier	Drop carrier
AT+FRM=96	CONNECT <TCF data> <DLE><ETX> NO CARRIER	Detect carrier Receive TCF Detect carrier loss	Wait 75 msec. Send V.29 carrier Send TCF data Drop carrier
AT+FTH=3 <CFRframe data> <DLE><ETX>	CONNECT OK	Send V.21 carrier Send flags Send CFR frame Send FCS Drop carrier	Detects carrier Detects flags Receives CFR
AT+FRM=96	CONNECT <page image data> <DLE><ETX>	Detect carrier Receive page Detect carrier loss	Send V.29 carrier Send page data Drop carrier
AT+FRH=3	CONNECT <EOP frame data> <DLE><ETX> OK	Detects carrier Detects flag Receives EOP Receives FCS Accepts FTS	Wait 75 msec. Sends V.21 carrier Sends flag Sends EOP packet Send CRC
AT+FRH=3	NO CARRIER	Detects loss of carrier	Drops carrier
AT+FTH=3	CONNECT	Send V.21 carrier Send flags	Detect carrier Detect flags
<MCF frame data> <DLE><ETX>	OK	Send MCF frame Send FCS Drop carrier	Receive MCF frame
AT+FRH=3	CONNECT <DCN frame data> <DLE><ETX> OK	Receives carrier Detects flags Receives DCN Receives FCS Accepts FCS	Send V.21 carrier Send flags Send DCN frame Send FCS
AT+FRH=3	NO CARRIER	Detect loss of carrier	Drops carrier
ATH0	OK	Hangs up	





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# Modem *Module*

## Chapter 4 - Class 2 Fax Commands

## Introduction

This chapter provides fax software developers with specific Class 2 fax command protocol information to be used in development with Lucent L33xVCS modem chip set. It is assumed that users have an understanding of ITU-TSS T.30 and T.4 concepts. The "fax command protocol" is defined here as the set of AT Commands used to control the sending/receiving of faxes. The term "fax" is defined as a specialized file transfer protocol for transferring black and white bit mapped images.

AT commands are used to control parameters for this file transfer and to initiate a particular action in the fax protocol. They also provide responses to indicate the progress and status of the transfer.

## Class 2 Fax Command Implementation

The MultiModems implement an extension to the AT Command set for controlling fax transmission and reception, which is in compliance with EIA proposed standard TIA-592 (August, 1990) as specified by EIA subcommittee TR29.2. It involves a set of new commands, responses and procedures.

## Class 2 Fax Commands (EIA SP-2388 August 1990)

The Lucent L56xVCS Chip Set supports fax Class 2 (August '90) commands. These commands and short descriptions of the commands are provided below. For more detailed information, refer to the August 1990 proposal.

**Note:** The EIA SP-2388 August 1990 proposal is being updated and will be made available when completed.

### **+FAA            FAX Auto Answer Enable**

Command Syntax:     +FAA=<value>

- 0: Answer as FAX modem of type specified by +FCLASS
- 2: Automatically determine whether to answer as FAX or data modem

### **+FAXERR        T.30 Session Error Report**

Command syntax:     +FAXERR

Response syntax:    +FAXERR=<value>

- 0 - 9    Call placement and termination
  - 0: Normal and proper end of connection
  - 1: Ring detected without successful handshake
  - 2: Call aborted, from +FK or <CAN>
- 10 - 19 Transmit phase A and miscellaneous errors
- 20 - 39 Transmit phase B hang-up codes
  - 20: Unspecified transmit phase B error
  - 23: COMREC invalid command received
  - 25: DCS sent 3 times without response
  - 27: Failure to train
- 40 - 49 Transmit phase C hang-up codes
  - 40: Unspecified transmit phase C error

50 - 69 Transmit phase D hang-up codes

- 52: No response to MPS repeated 3 times
- 53: Invalid response to MPS
- 54: No response to EOP repeated 3 times
- 55: Invalid response to EOP
- 56: No response to EOM repeated 3 times
- 57: Invalid response to EOM

70 - 89 Receive phase B hang-up codes

90 - 99 Receive phase C hang-up codes

- 90: Unspecified receive phase C error

100 - 119 Receive phase D hang-up codes

- 100: Unspecified receive phase D error

120 - 255 Reserved codes

### **+FBOR      Data Bit Order Selection**

Command syntax:      +FBOR=<value>

- 0: Direct bit order for both Phase C data and for Phase B/D data
- 1: Reversed bit order for Phase C data and direct bit order for Phase B/D data
- 2: Direct bit order for Phase C data and reversed bit order for Phase B/D data
- 3: Reversed bit order for both Phase C data and for Phase B/D data

**Note:** Direct bit order: First bit transferred of each byte on the DTE-DCE link is the first bit transferred in the PSTN data carrier.

Reversed bit order: Last bit transferred of each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier.

### **+FCQ      Copy Quality Checking**

Command syntax:      +FCQ=<value>

- 0: Disables copy quality checking. The modem will generate Copy Quality OK (MCF) responses to complete pages and set +FPTS=1.

### **+FCR      Capability to Receive**

Command syntax:      +FCR=<value>

- 0: Indicates the modem will not receive message data.
- 1: Indicates the modem can receive message data.

### **+FCTCRTY      ECM Retry Count**

Command syntax:      +FCTCRTY=<value>

- 0: Disable error correcting mode retries. Error correcting mode is not supported.

**+FDCC Fax Capability Parameters**

Command syntax: +FDCC=VR, RB, WD, LN, DF, EC, BF, ST

Response syntax: VR, BR, WD, LN, DF, EC, BF, ST

Valid values:

- VR: Vertical resolution
  - 0: Normal, 98 lpi
  - 1: Fine, 196 lpi
  
- BR: Bit rate
  - 0: 2400 bits/s V.27ter
  - 1: 4800 bits/s V.27ter
  - 2: 7200 bits/s V.29 or V.17
  - 3: 9600 bits/s V.29 or V.17
  - 4: 12000 bits/s V.33 or V.17
  - 5: 14400 bits/s V.33 or V.17
  
- WD: Page width
  - 0: 1728 pixels in 215 mm
  
- LN: Page length
  - 0: A4, 297 mm
  - 2: Unlimited length
  
- DF: Data compression format
  - 0: 1-D modified Huffman
  
- EC: Error correction
  - 0: Disable ECM
  
- BF: Binary file transfer
  - 0: Disable BFT
  
- ST: Scan time/line

	VR = normal	VR = Fine
0:	0 ms	0 ms
1:	5 ms	5 ms
2:	10 ms	5 ms
3:	10 ms	10 ms
4:	20 ms	10 ms
5:	20 ms	20 ms
6:	40 ms	20 ms
7:	40 ms	40 ms

**+FDCS Current Session Results**

Command syntax: +FDCS?

Response syntax: +FDCS=VR, BR, WD, LN, DF, EC, BF, ST

Valid values:

- VR: Vertical resolution
  - 0: Normal, 98 lpi
  - 1: Fine, 196 lpi
  
- BR: Bit rate
  - 0: 2400 bits/s V.27ter
  - 1: 4800 bits/s V.27ter
  - 2: 7200 bits/s V.29 or V.17
  - 3: 9600 bits/s V.29 or V.17

	4: 12000 bits/s V.33 or V.17	
	5: 14400 bits/s V.33 or V.17	
WD:	Page width	
	0: 1728 pixels in 215 mm	
LN:	Page length	
	0: A4, 297 mm	
	2: Unlimited length	
DF:	Data compression format	
	0: 1-D modified Huffman	
EC:	Error correction	
	0: Disable ECM	
BF:	Binary file transfer	
	0: Disable BFT	
ST:	Scan time/line	
	VR = normal	VR = Fine
0:	0 ms	0 ms
1:	5 ms	5 ms
2:	10 ms	5 ms
3:	10 ms	10 ms
4:	20 ms	10 ms
5:	20 ms	20 ms
6:	40 ms	20 ms
7:	40 ms	40 ms

#### **+FDFFC Data Compression Format Conversion**

Command syntax: +FDFFC=<value>

- 0: Disable mismatch checking. The DTE must check the +FDCCS:DF subparameter and transfer matching data.

#### **+FDIS Current Session Parameters**

Command syntax: +FDIS=VR,RB,WD,LN,DF,EC,BF,ST

Response syntax: VR,BR,WD,LN,DF,EC,BF,ST

Valid values:

VR: Vertical resolution.

0: Normal, 98 lpi

1: Fine, 196 lpi

BR: Bit rate.

0: 2400 bits/s V.27ter

1: 4800 bits/s V.27ter

2: 7200 bits/s V.29 or V.17

3: 9600 bits/s V.29 or V.17

4: 12000 bits/s V.33 or V.17

5: 14400 bits/s V.33 or V.17

WD: Page width.

0: 1728 pixels in 215 mm

LN: Page length.

0: A4, 297 mm

2: Unlimited length

DF:	Data compression format.	
	0: 1-D modified Huffman	
EC:	Error correction.	
	0: Disable ECM	
BF:	Binary file transfer.	
	0: Disable BFT	
ST:	Scan time/line.	
	VR = normal	VR = Fine
0:	0 ms	0 ms
1:	5 ms	5 ms
2:	10 ms	5 ms
3:	10 ms	10 ms
4:	20 ms	10 ms
5:	20 ms	20 ms
6:	40 ms	20 ms
7:	40 ms	40 ms

**+FDR            Begin or Continue Phase C Receive Data**

Command syntax:    +FDR

This command will initiate a transition to Phase C data reception.

**+FDT            Begin Phase C Data Transmission**

Command syntax:    +FDT

This command prefixes Phase C data reception.

**+FECM          Error Correction Mode Control**

Command syntax:    +FECM=<value>

0: Error correcting mode disabled.

**+FET            Transmit Page Punctuation**

Command syntax:    +FET=<ppm>

- 0: [PPS-]MPS Another page next, same document
- 1: [PPS-]EOM Another document next
- 2: [PPS-]EOP No more pages or documents
- 3: PPS-NULL Another partial page next
- 4: [PPS-]PRI-MPS Another page, procedure interrupt
- 5: [PPS-]PRI-EOM Another document, procedure interrupt
- 6: [PPS-]PRI-EOP All done, procedure interrupt
- 7: CTC Continue to correct.

This command is used to punctuate page and document transmission, after one or more +FDT commands.

**+FK            Session Termination**

Command syntax:     +FK

This command causes the modem to terminate the session in an orderly manner.

**+FLID        Local ID String**

Command syntax:     +FLID="<local ID string>"

Valid values:        ASCII string can be up to 20 characters

Response syntax:    +FLID=?

Return value:       (20),(32 - 127)

**+FLNFC      Page Length Format Conversion**

Command syntax:     +FLNFC=<value>

0: Disables mismatch checking. The DTE must check the +FDCS:LN subparameter and transfer matching data.

**+FLPL      Indicate Document to Poll**

Command syntax:     +FLPL=<value>

0: Indicates that the DTE has no document to poll.

**+FMDL      Request Model Identification**

Command syntax:     +FMDL?

Response value:     The information text cannot exceed 2048 characters.

This command causes the modem to send one or more lines of information text which is used to identify the product .

**+FMFR      Manufacturer Identification**

Command syntax:     +FMFR

Response value:     The information text cannot exceed 2048 characters.

This command causes the modem to send one or more lines of information text which is used to identify the manufacturer.

**+FREVL     Request Product Revision Identification**

Command syntax:     +FREV?

Response value:     The information text cannot exceed 2048 characters.

This command causes the modem to send one or more lines of information text which is used to identify the version, revision level or data, or other pertinent information.

**+FPHCTO    DTE Phase C Response Time-out**

Command syntax:     +FPHCTO=<value>

value = 0—255 (100 ms units)

Default value:       30

This value determines how long the modem will wait for a command after reaching the end of data when transmitting in Phase C.

**+FPTS      Page Transfer Status**

Command syntax:      +FPTS=<ppr>  
                           1: MCF Page good  
                           2: RTN Page good; retrain requested  
                           3: RTP Page good; retrain requested.

**+FRBC      Phase C Receive Data Block Size**

Command syntax:      +FRBC=<value>  
                           0: Stream mode, Phase C data is terminated by <DLE><ETX>.

**+FREL      Phase C Received EOL Alignment**

Command syntax:      +FREL=<value>  
                           0: Indicates that EOL patterns are aligned as received (Default).  
                           1: Indicates that the last received bits of EOL patterns are byte aligned by DCE, with necessary zero fill bits inserted. There are two 2-byte patterns:

<u>+FBOR</u>	<u>binary EOL pattern</u>	
0	0000xxxx	10000000
1	xxxx0000	00000001

xxxx represents previous data bits, zero bits, or other leading data.

**+FSPL      Request to Poll**

Command syntax:      +FSPL=<value>  
                           0: Indicates that the DTE does not want to poll.

**+FTBC      Phase C Transmit Data Block Size**

Command syntax:      +FTBC=<value>  
                           0: Stream mode, Phase C data is terminated by <DLE><ETX>.

**+FCFR      Indicates Confirmation to Receive**

Syntax:                   +FCFR  
 Usage:                   Indicates the reception of an acceptable TCF training burst and valid DCS signal from the remotemachine.

**+FCON      Facsimile Connection Response**

Syntax:                   +FCON  
 Usage:                   Indicates connection with a FAX machine. Generated in response to an originate command or answer command.

**+FCSI      Reports the Remote ID**

Syntax:                   +FCSI:"<CSI ID string>"  
 Usage:                   Reports the called station's ID.

**+FDCS      Reports DCS Frame Information**

Syntax:                   +FDCS:VR,BR,WD,LN,DF,EC,BF,ST  
 Usage:                   Reports negotiated parameters for the current session. The subparameters are described in the +FDCS command description.



<b>+FDIS</b>	<b>Reports DIS Frame Information</b>
Syntax:	+FDIS:VR,BR,WD,LN,DF,EC,BF,ST
Usage:	Reports remote FAX capabilities and intentions. The subparameters are described in the +FDCS command description.
<b>+FET</b>	<b>Post Page Message Response</b>
Syntax:	+FET:<ppm>
Usage:	Generated by the receiving modem after the end of Phase C reception, on receipt of the postpage message from the transmitting station. The <ppm> codes are described in the +FET command description.
<b>+FHNG</b>	<b>Call Termination with Status</b>
Syntax:	+FHNG:<hang-up status code>
Usage:	Indicates that the call has been terminated. The <hang-up status code> values are described in the +FAXERR command description.
<b>+FPTS</b>	<b>Receive/Transmit Page Transfer Status</b>
Syntax:	+FPTS:<ppr>
Usage:	Reports a <ppr> number representing the copy quality and related post page message. The valid <ppr> values are defined in the +FPTS command description.
<b>+FTSI</b>	<b>Report the Remote ID</b>
Syntax:	+FTSI:"<TSI ID string>"
Usage:	Reports the transmitting station's ID.

### For More Information

To obtain Data and Fax specifications and standards (e.g., Class 1 documents (EIA/TIA-578), and Class 2 documents - EIA/TIA Project Number 2388, Async Fax DCE Control Standard Service Class 2, TR29.2), contact:

Telecommunications Industry Association (TIA)  
 2500 Wilson Boulevard  
 Suite 300  
 Arlington, VA 22201  
 Ph: 703-907-7700  
<http://www.tiaonline.org/>

The ITU is the leading publisher of international telecommunication standards. For further information contact [sales@itu.int](mailto:sales@itu.int) or <http://www.itu.int/publications/index.html>

Global Engineering maintains extensive collections of documents from more than 400 standards-developing organizations worldwide, including: TIA/EIA-578 - Class 1 documents, TIA/EIA-592 - Class 2 documents.

EIA TSB 43 (corrections to TIA/EIA-578), EIA SP 2987 (draft of changes to TIA/EIA-578), and CCITT v7.3 - T.1-T.90 standards (including (T.4 and T.30)). Contact:

Global Engineering Documents  
 800-854-7179 (phone)  
 303-792-2192 (fax)  
<http://global.ihs.com/>



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# Modem *Module*

## Chapter 5 - Remote Configuration

## Introduction

Remote configuration is a network management tool that allows you to configure modems anywhere in your network from one location. With password-protected remote configuration, you can issue AT commands to a remote MT3334SMI for maintenance or troubleshooting as if you were on-site.

## Basic Procedure

The following steps are valid regardless of whether the connection is established by the local or the remote Multi-Tech modem.

1. Establish a data connection with a remote MT3334SMI modem.
2. Send three remote configuration escape characters followed by **AT** and the setup password, and press ENTER. Example: **%%%ATMTSMODEM<CR>**. You have four tries to enter the correct password before being disconnected. If the password is correct, the remote modem responds with **OK**.
3. You can now send AT commands to configure the remote modem.
4. When you have finished configuring the remote modem, save the new configuration by typing **AT&W0<CR>**, then type **ATO<CR>** to exit remote configuration. You can then break the connection in the normal way.

---

**CAUTION:** If you hang up while you are in remote configuration mode, it may lock up the remote modem.

---

## Setup

Multi-Tech modems are shipped with a default setup password (MTSMODEM). Because anyone who has an owner's manual knows the default setup password, for security you should change the password and possibly also the remote configuration escape character.

### Changing the Setup Password

1. Open a data communications program such as HyperTerminal.
2. In the terminal window, type **AT#SMTSMODEM** (or **AT#Syyyyyy** if you have replaced the MTSMODEM password with yyyyyy) and press ENTER. The modem responds with **OK** if the setup password is correct and **ERROR** if it is wrong.
3. To change the password, type **AT#S=yyyyyy**, where yyyyyy stands for the password, and press ENTER. The password can include any keyboard character and must be one to eight characters long. The modem responds with **OK**.
4. The new password is saved automatically. You can now either enter more AT commands or exit the data communications program. The next time you remotely configure the modem you must use the new setup password.

---

**CAUTION:** You can only change the setup password locally; you cannot do it remotely. Also, passwords are case sensitive. The next time you enter the password, it must be in the same case as you set it up.

---

### Changing the Remote Escape Character

To increase security, you can change a remote modem's remote configuration escape character. The remote configuration escape character is stored in register **S9**. The factory default is 37, which is the ASCII code for the percent character (%). Setting **S9** to 0 (zero) disables remote configuration entirely—but if you do this remotely, you won't be able to change it back remotely!

1. Establish a remote configuration link with the remote modem as described in "Basic Procedure."
2. Type **ATS9=*n***, where *n* is the ASCII code for the new remote configuration escape character, then press ENTER.
3. Save the new value by typing **AT&W** and pressing ENTER.
4. Type **ATO<CR>** to exit remote configuration.



---

# Modem *Module*

## Chapter 6 - Troubleshooting

## Introduction

Each time you turn on your modem, it performs an automatic self-test to ensure proper operation. Your modem also has three diagnostic tests: local analog loopback, remote digital loopback, and local digital loopback. These ITU-T V.54 loopback tests isolate telephone circuit and transmission problems.

In a loopback test, data from your computer loops through the circuits of your modem and/or a remote modem before it appears on your monitor. When the loop has been completed, the data on your PC's monitor should match the original data.

The local analog loopback test allows you to verify that the modem's transmitter and receiver circuits are functioning properly.

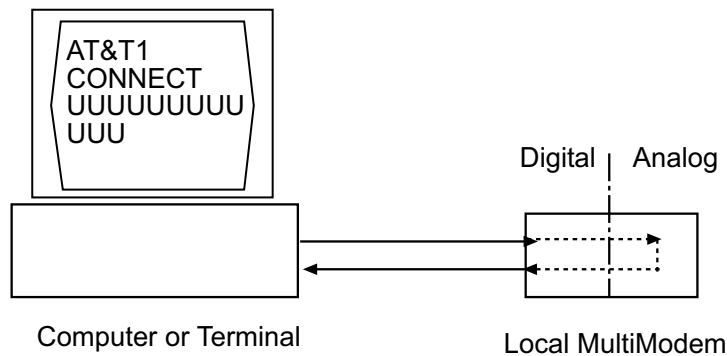
The local digital loopback allows you to verify that the local computer or terminal, the two modems, and the transmission line between them are functioning properly.

The remote digital loopback test allows you to verify that the remote computer or terminal, the remote modem, the serial ports, the telephone line, and the local modem are functioning properly.

**Note:** All loopback tests operate at all speeds except 300 bps.

### Local Analog Loopback Test (V.54 Loop 3)

In this test, data from your computer or terminal is sent to your modem's transmitter, converted into analog form, looped back to the modem's receiver, converted into digital form, and then sent to your monitor for verification. No connection to the phone line is required.



**Figure 6-1. Local analog loopback test.**

#### Test procedure

1. Connect the modem to your computer. Using your communication program, set the desired baud rate and go into terminal mode.
2. Type **AT&T1** and press ENTER. This places your modem in analog loopback mode in the originate mode. A *CONNECT* message should appear on your display. The modem is now out of command mode and in a pseudo-online mode.
3. Note that the CD LED is on. If you are set for 14,400 bps or higher, a speed LED should be on. If the CD LED is not on, there is a defect in your modem.
4. Enter characters from your keyboard. For this test, typing multiple uppercase *U* characters is a good way to send an alternating test pattern of binary ones and zeros. The characters entered should be displayed on your monitor. The TD and RD LEDs should flash when a character is entered.
5. To exit the test, type the escape sequence **+++AT** and press ENTER. This puts the modem in online command mode. Then type either **AT&T** or **ATH** to return to command mode.



- Your modem passes this test if the data received on your monitor are the same as the data entered from your keyboard. If different data appear on your monitor, your modem is probably causing the problem, though it could also be your computer. If your modem passes this test, but you are receiving errors while on line, the remote modem or the phone line could be at fault.

## Remote Digital Loopback Test (V.54 Loop 2)

The remote digital loopback test tests the phone lines and the circuits of both your modem and a remote modem. In this test, your modem must be on line with another modem that is set up to respond to a request for remote digital loopback. (Note that some modems might not support remote digital loopback or might have it disabled.) Data from your computer or terminal is transmitted through your modem and over the phone line to the remote modem, where it is then looped back to your modem.

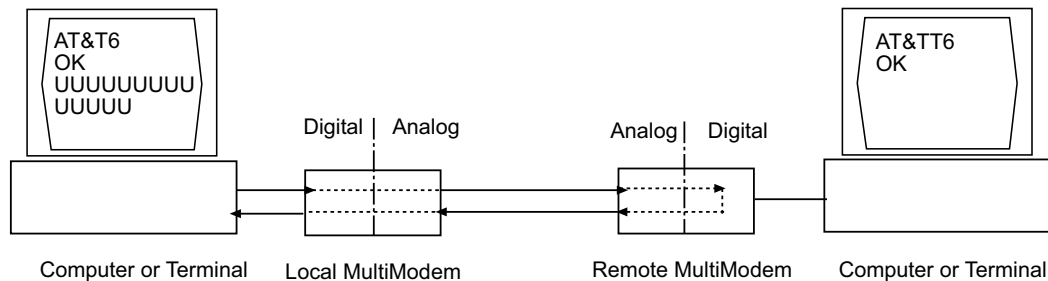


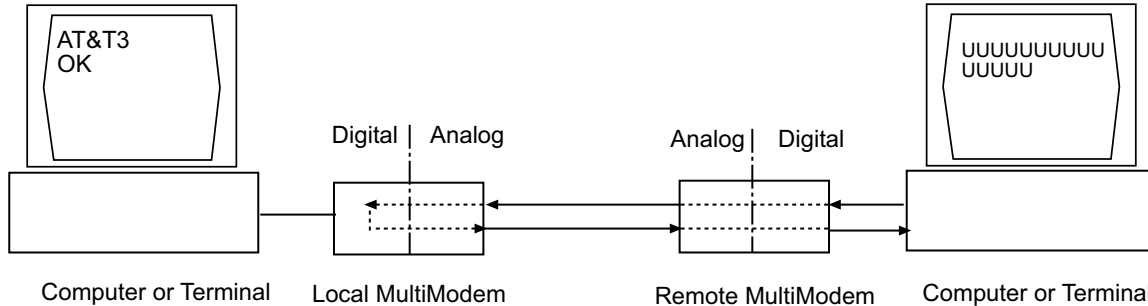
Figure 6-2. Remote digital loopback test.

### Test procedure

- Arrange to have **&T6** set on the remote test modem.
- Open your communications software and go into terminal mode. Type **AT** and press ENTER; you should get an *OK* message. Type **ATN** and press ENTER to disable error correction.
- Dial the remote modem and establish your online connection.
- Type the escape sequence **+++AT** and press ENTER to bring your modem into online command mode.
- Type **AT&T6** and press ENTER. The local modem responds to this command by transmitting an unscrambled marking signal, which causes the remote modem to place itself in digital loopback mode. Then the local modem exits online command mode and enters data mode.
- Enter data from your keyboard. For this test, typing multiple uppercase *U* characters is a good way to send an alternating test pattern of binary ones and zeroes. Data received by the remote modem enters its analog receiver, is converted to digital data, is reconverted into analog, and then is transmitted back to your modem. Your modem passes this test if the data received on your monitor is the same as the data entered from your keyboard.
- To exit the test, type the escape sequence **+++AT** and press ENTER. This puts the modem in online command mode. The modem should respond with an *OK* message. If you wish to stay on line with the remote modem for normal data transmission, type **AT&T** and press ENTER to exit the test, then type **ATO** and press ENTER to return on line. If you wish to terminate the call, type **ATH** and press ENTER to hang up.

## Local Digital Loopback Test (V.54 Loop 2)

The local digital loopback test is identical to the remote digital loopback test with one exception. Instead of using your modem to signal a remote modem to place itself in digital loopback mode, your modem is placed in digital loopback mode while the remote modem is not. Data is entered and transmitted from the remote modem, sent across the phone line to your modem, and looped back to the remote modem.



**Figure 6-3. Local digital loopback test**

### Test Procedure

1. Open your communications software and go into terminal mode. Type **AT** and press ENTER; you should get an *OK* message. Type **ATN** and press ENTER to disable error correction.
2. Dial the remote modem and establish your online connection.
3. Type the escape sequence **+++AT** and press ENTER to bring your modem into online command mode.
4. Type **AT&T3** and press ENTER. Once you receive an *OK* message from your modem (if responses are enabled), your modem is placed in digital loopback mode.
5. Have someone enter data from the remote keyboard. For this test, typing multiple uppercase *U* characters is a good way to send an alternating test pattern of binary ones and zeros. The data received by your modem enters its analog receiver, is converted to digital data, is reconverted into analog, and then is transmitted back to the remote modem. Your modem passes this test if the data received on the remote monitor is the same as the data entered from the remote keyboard.
6. To exit the test, type the escape sequence **+++AT** and press ENTER. This puts the modem in online command mode. The modem should respond with an *OK* message. If you wish to stay on line with the remote modem for normal data transmission, type **AT&T** and press ENTER to exit the test, then type **ATO** and press ENTER to return on line. If you wish to terminate the call, type **ATH** and press ENTER to hang up.

---

# Modem *Module*

## Chapter 7 - Upgrade Procedure

## Introduction

Your ModemModule is controlled by semi-permanent *firmware* that is stored in flash memory. Firmware is nonvolatile; it remains stored in memory when the modem is turned off. However, it can be changed by either the manufacturer or the user as bugs are fixed or new features are added.

Since the firmware is stored in flash memory, you can upgrade it yourself in a few minutes by using the following procedures.

## Upgrade Overview

The upgrade procedure consists of the following steps.

1. Identify the model number and firmware version of your modem.
2. Identify the current version of the firmware at the Multi-Tech Web site or BBS. If your modem already has the current firmware, there is no need to update it.
3. Download the upgrade file for your modem.
4. Extract the firmware .HEX file and appropriate flash upgrade program from the downloaded file.
5. Document and clear your stored parameters.
6. Upgrade the modem's firmware using the .HEX file and the flash upgrade program.
7. Restore your parameters.

### Step 1: Identify the Modem Firmware

You must know the model number and firmware version of your Multi-Tech modem to know whether you should update it.

1. Run your favorite terminal program. If you are using Windows 95/98 or Windows NT, you can use HyperTerminal. If you are using Windows 3.11, you can use Windows Terminal.
2. In the program's terminal window, type **AT&F**. Even if you cannot see the **AT&F** command on your screen, be sure to type it completely and then press ENTER.
3. Type **ATI** and record your results. The model number and firmware version is displayed:

```
LT 33.6 MT3334SMI Serial Data/Fax/Voice Modem Version 4.16
```

### Step 2: Identify the Current Firmware Version

Identify the current version of the firmware at the Multi-Tech Web site or BBS. If your modem already has the current firmware, there is no need to update it.

#### Multi-Tech Web Site

1. Using your favorite Web browser, go to <http://www.multitech.com/support/firmware.htm>.
2. Scroll down to the table with your modem model number (non-USA firmware must be obtained directly from the ftp site or BBS at this time).
3. Look at the Current Revision number for your modem.
4. If the Current Revision number matches the firmware version number found in Step 1, your modem has the current firmware version and does not need to be updated.
5. If the Current Revision number is larger than the firmware version number found in "Step 1: Identify the Modem Firmware," your modem has an older firmware version. Continue with Step 3.

---

**Multi-Tech BBS**

1. Run your favorite terminal program and dial in to the Multi-Tech BBS at 800-392-2432 (North America) or 612-785-3702 (local and international). If you followed the download test in the Quick Start chapter, your terminal program should already be configured for the Multi-Tech BBS.
2. When the BBS welcome screen is displayed, type your first name, last name, and password following the prompts. If you are a first-time caller, the BBS asks if your name is spelled correctly. If you answer **Y**, complete the questionnaire that is displayed to use the BBS on your first call.
3. Press ENTER until the main menu appears. From the main menu you have access to two areas: the Files Menu and News. For help with menu commands, type **?**.
4. In the Main Menu, type **F** and press ENTER to access the Files Menu.
5. In the Files Menu, type **L** and press ENTER, then type **L** and press ENTER again. A two-column list of file areas appears.
6. Press ENTER until the modem firmware area for your country is listed.
7. Type the number of the modem firmware area for your country and press ENTER.
8. Type **L** and press ENTER to list the files in the selected area.
9. Press ENTER until your modem model number appears.
10. Look at the version number for your modem.
11. If the version number matches the firmware version number found in "Step 1: Identify the Modem Firmware," your modem has the current firmware version and does not need to be updated.
12. If the version number is larger than the firmware version number found in "Step 1: Identify the Modem Firmware," your modem has an older firmware version. Continue with "Step 3: Download the Upgrade File."

**Step 3: Download the Upgrade File****Multi-Tech Web Site**

1. If you are not already at the Firmware page of the Multi-Tech Web site, follow the procedure in "Step 2: Identify the Current Firmware."
2. Click on the upgrade file name for your modem and save the file to a temporary location on your hard disk.

**Multi-Tech BBS**

1. If you have not already found the upgrade file for your modem on the Multi-Tech BBS, follow the procedure in "Step 2: Identify the Current Firmware."
2. Type the number of the upgrade file for your modem and press ENTER.
3. Type **D** and press ENTER to list the file to be downloaded.
4. If the correct file is listed, press ENTER; otherwise use the **Q** command to return to the previous menu.
5. Type **Z** and press ENTER to select the Zmodem transfer protocol.
6. The download begins automatically. As the file is copied to your hard disk, a dialog box reports on the progress of the download.
7. To log off the BBS, press ENTER, type **G** for "good-bye," and press ENTER twice more.

## Step 4: Extract the Upgrade Files

1. Move the downloaded upgrade file to a temporary directory or folder on your hard disk.
2. The file is a self-extracting archive. Extract the files by typing the upgrade file name in DOS or double-clicking it in Windows. The extracted files include a .HEX file, which contains the upgrade data, and one flash program each for DOS, Windows 3.1/95/98, and Windows NT.

## Step 5: Clear Your Stored Parameters

Before you flash your modem it is important that you issue the **AT&W1Z** command to it to clear out any stored parameters. You should also record the parameters that are currently stored in your modem so you can reprogram it after flashing.

1. Run your favorite terminal program. If you are using Windows 95/98 or Windows NT, you can use HyperTerminal. If you are using Windows 3.11, you can use Windows Terminal.
2. In the program's terminal window, type **AT&V** and press ENTER to list your modem's current parameters.
3. Record your parameters by saving the screens and sending them to your printer.
4. Type **AT&W1Z** and press ENTER to clear your stored parameters and reset your modem to factory default.
5. Close the terminal program.

## Step 6: Use FlashPro to Upgrade Modem Firmware

At various times, Multi-Tech may add enhancements and/or fixes to the firmware. Flash technology allows you to load these upgrades into the PROM. Do the following.

1. Download FLASHPRO.ZIP and a new .HEX file from the Multi-Tech BBS.
2. Unzip the FLASHPRO.ZIP file. Place this unzipped file and the .HEX file in the same directory.
3. Run FlashPro by typing FLASHPRO, a space, and hitting ENTER at the DOS prompt.
4. Highlight the "Configure" option in the MAIN MENU and hit ENTER. Highlight "Active Port" and select the COM port to which you have your modem attached. Highlight "Baud Rate" and select the rate you want to program at. Hit ESC when finished.
5. Highlight the "Select File to Program" option in the MAIN MENU. Highlight the .HEX file. Hit ESC when finished.
6. Highlight "Program Firmware" option in the MAIN MENU. When you are prompted to confirm the file to program, press "Y".
7. If you need more assistance programming FLASHPRO, contact our Technical Support department.

## Step 7: Restore Your Parameters

Your modem is now updated. You can now open your terminal program to reprogram your modem parameters, if necessary, or to confirm the update by typing **ATI** in the terminal window.

---

# Modem *Module*

## Appendixes

## Appendix A - Regulatory Agency Compliance

### FCC Regulations for Telephone Line Interconnection

1. This equipment complies with Part 68 of the Federal Communications Commission (FCC) rules. On the outside surface of this equipment is a label that contains, among other information, the FCC registration number. This information must be provided to the telephone company.
2. As indicated below, the suitable USOC jack (Universal Service Order Code connecting arrangement) for this equipment is shown. If applicable, the facility interface codes (FIC) and service order codes (SOC) are shown.
3. An FCC-compliant telephone cord and modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.
4. The ringer equivalence number (REN) is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the RENs should not exceed five (5.0). To learn the number of devices that may be connected to the line, contact the telephone company to determine the maximum REN for the calling area.
5. If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.
6. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.
7. If trouble is experienced with this equipment (the model of which is indicated below) please contact Multi-Tech Systems, Inc. at the address shown below for details on how to have repairs made. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.
8. No repairs are to be made by you. Repairs are to be made only by MultiTech Systems or its licensees. Unauthorized repairs void registration and warranty.
9. This equipment should not be used on party lines or coin lines.
10. If so required, this equipment is hearing-aid compatible.

Manufacturer: Multi-Tech Systems, Inc.  
Trade Name: ModemModule  
Model Number: MT3334SMI  
FCC Registration No: AU7USA-25814-M5-E  
Ringer Equivalence: 0.3B  
Modular Jack (USOC): RJ11C or RJ11W (single line)

Service Center in USA: Multi-Tech Systems, Inc.  
2205 Woodale Drive  
Mounds View, MN 55112  
(800) 328-9717  
(612) 785-3500  
(612) 785-9874 FAX



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### Canadian Limitations Notice:

**NOTICE:** The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Industry Canada label does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

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**Caution:** Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

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The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 5.

This digital apparatus does not exceed Class B limits for radio noise for digital apparatus set out in ICES-003 of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

### FCC FAX Update

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone fax machine unless such message clearly contains in a margin at the top or bottom of each page or the first page of the transmission, the date and time the message is sent and an identification of the business or other entity, or other individual sending the message and the telephone number of the sending machine or such business, other entity, or individual.

See your fax software manual for setup details.

### International Modem Restrictions

Some dialing and answering defaults and restrictions may vary for international modems. Changing settings may cause a modem to become non-compliant with national telecom requirements in specific countries. Also note that some software packages may have features or lack restrictions that may cause the modem to become non-compliant.



## EMC, Safety and Terminal Directive Compliance

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility.  
and

Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits:  
and

Council Directive 98/13/EEC of 12 March 1998 on the approximation of the laws of Member States concerning telecommunications terminal and Satellite earth station equipment.

## European Directives User Guide Statement

The equipment has been approved to [Commission Decision"CTR21"] for pan-European single terminal connection to the Public Switched Telephone Network (PSTN). However, due to differences between the individual PSTNs provided in different countries, the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN network termination point. In the event of problems, you should contact your equipment supplier in the first instance.

This equipment is designed with PSTN networks that accept analog signals. Multi-Tech does not currently know of any interoperating difficulties.

## New Zealand Telecom Warning Notice

The grant of a Telepermit for any item of terminal equipment indicates only that Telecom has accepted that the item complies with minimum conditions for connection to its network. It indicates no endorsement of the product by Telecom, nor does it provide any sort of warranty. Above all, it provides no assurance that any item will work correctly in all respects with another item of Telepermitted equipment of a different make or model, nor does it imply that any product is compatible with all of Telecom's network services.

***This device is equipped with pulse dialing, while the Telecom standard is DTMF tone dialing. There is no guarantee that Telecom lines will always continue to support pulse dialing.***

Use of pulse dialing, when this equipment is connected to the same line as other equipment, may give rise to 'bell tinkle' or noise and may also cause a false answer condition. Should such problems occur, the user should NOT contact the Telecom Faults Service.

The preferred method of dialing is to use DTMF tones, as this is faster than pulse (decadic) dialing and is readily available on almost all New Zealand telephone exchanges.

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**Warning Notice:** No '111' or other calls can be made from this device during a mains power failure.

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This equipment may not provide for the effective hand-over of a call to another device connected to the same line.

Some parameters required for compliance with Telecom's Telepermit requirements are dependent on the equipment (PC) associated with this device. In order to operate within the limits for compliance with Telecom's Specifications, the associated equipment shall be set to ensure that calls are answered between 3 and 30 seconds of receipt of ringing.

If a charge for local calls is unacceptable, the "Dial" button should NOT be used for local calls. Only the 7-digits of the local number should be dialed from your telephone. DO NOT dial the area code digit or the "0" prefix.

# Appendix B - Multi-Tech Flash Programming Protocol

## Introduction

This appendix describes the protocol by which the modems are flash programmed.

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## 1. Programming the Modem

There are two ways to start flash programming a modem. It can be programmed either from "AT" mode or right when the modem powers up.

Below is an example of how a modem is programmed.

<u>DTE</u>	<u>Modem</u>	<u>Comments</u>
AT*FS\r		This effectively "restarts" the modem so that it enters the boot code.
<b>Handshake Sequence</b>		
M's		Many M's are sent (10 milliseconds apart) at 19200 baud.
		This is where the handshake starts if the modem is just powered up
	U	U is sent at 19200 baud if M's are received within 30 milliseconds of power up (see section 3.6). If the M's are not received within 30 milliseconds, then the modem starts up normally.
D		Sent at 19200 baud
	J K M	J if can receive only at 19200 K if can receive only at 19200/3840 M if can receive at 9600/19200/38400/57600/115200
I J K L M		I if modem will be programmed at 9600 J if modem will be programmed at 19200 K if modem will be programmed at 38400 L if modem will be programmed at 57600 M if modem will be programmed at 115200
	\r\nOK\r\n	Modem is ready to be programmed

**Program Sequence**

<u>DTE</u>	<u>Modem</u>	<u>Comments</u>
ATFLP\r		Request to the modem to program
	G	Modem is ready for next program packet
[Length High]		High byte of data packet length
[Length Low]		Low byte of data packet length Packet lengths can be up to 4096 bytes in size for most boot code versions (see section 3.5)
[Address High]		High byte of program address
[Address Middle]		Middle byte of program address
[Address Low]		Low byte of program address Addresses are 3 byte values with a range of 00000h-FFFFFh (see sections 3.2 - 3.4)
[Data Bytes]		These are the data bytes to be programmed at the address specified above. They must be the same number of bytes as specified above. (see section 3.1)
[Checksum]		This checksum is generated by exclusive ORing together all of the Data Bytes (do not include the Length or Address bytes in that calculation).
	\nOK\r\n	If bytes are programmed and verified.
	\nERROR\r\n	If verify fails or checksum is bad. Retry the block 3 times on an ERROR.
....	....	More of the above sequence until all the data bytes have been sent to the modem.
ATFLEND\r		This ends programming and restarts the modem

**2. Other supported boot code commands**

- 2.1. ATIO - returns 247
- 2.2. ATI1 - returns boot code version number MM.mm where  
MM = unique code for each different platform that has boot code  
mm = version number of boot code
- 2.3. AT\*FI - when given in standard AT mode gives the boot code version (same as in section 2.2). See section 3.7.

**3. Other programming concerns**

- 3.1. The values programmed into Addresses 0000h, 0001h and 0002h should always be forced to C3h 01h 00h (ie. JP 100h).  
  
This is because the boot code starts at address 100h, while all normal modem code starts at 200h. By allowing 0000h to be programmed to a jump value other than 0100h, the boot code would be bypassed and no further upgrades could occur.
- 3.2. Addresses 1E0000h through 1FFFFFh should not be allowed to be programmed under normal circumstances as this is the main body of the boot up code.

- 3.3. The packets sent to the modem must be presorted by address and aligned on 128 byte boundaries (ie. each packet must start on an address that is a multiple of 128).
- 3.4. The packets should also be a minimum of 128 bytes with the non-programmed bytes set to the hex value of FF.
- 3.5. The packets sent to the modem must not span a 4K boundary (ie. start the packet before it and go over the boundary in the middle of the packet).
- 3.6. The 10 millisecond delay between M's at the beginning of the handshake is so that the modem can sync up to the start bit. If the M's are sent one right after another, a data bit might be mistaken as a start bit.
- 3.7. Multi-Tech firmware files are in Intel Hex Format and must be read in and formatted into 128-4096 byte blocks before being sent to the modem.

Refer to the **Intel Hex Format** section below for information about the Intel Hex Format.

## Intel Hex Format

An Intel Format Hex File is a text file consisting of “records”, one per line, that start with a “:” character and include only digits 0-9 and letters A-F. There are three different record types: Extended Address Records, Data Records and End of File Records.

Data records contain the actual data that is to be programmed into a device. The address contained in the data record needs to be combined with an extended address (by adding the extended address shifted four bits left to the data record address) to determine the actual programming address for the data. If no extended address record is before a given data record in the file, then the extended address value is assumed to be zero.

The record types are described below:

### Data Record

<u>Char Pos</u>	<u>Field Type</u>	<u>Value</u>	<u>Description</u>
1	Record Start	“:”	
2-3	Data Byte Count	“NN”	Maximum value is FF (which is 255 data bytes). Typical is 20h which causes the hex record to fit in 80 columns.
4-7	Address	“XXXX”	Lower 16 bits of 20 bit address, most significant byte first. This must be added to Extended Address left shifted four bits.
<u>Char Pos</u>	<u>Field Type</u>	<u>Value</u>	<u>Description</u>
8-9	Record Type	“02”	Data Record
10+N	Data Bytes	“YY..YY”	The data bytes in hex. Each byte is two characters.
NN+1,2	Checksum	“ZZ”	Zero minus the two's complement addition of all data hex values.
NN+3,4	End of Line	“\r\n”	Carriage Return followed by a Line Feed

### Example Data Record in Intel Format

```
:2000A0005BB66DDBB66CD8B060C183060D1B366DDBB66DDBB76FDFBF7EFDFFBF6EDDBB66DD4
```

**Extended Address Record**

<u>Char Pos</u>	<u>Field Type</u>	<u>Value</u>	<u>Description</u>
1	Record Start	“.”	
2-3	Data Byte Count	“02”	Always 2 bytes for this record type
4-7	Address	“0000”	Not used for this record type (must be zero)
8-9	Record Type	“02”	Extended Address Record
10-13	Extended Address	“EEEE”	Top 16 bits of 20 bit address, most significant byte first
14-15	Checksum	“ZZ”	Zero minus the two's complement addition of all data hex values
16-17	End of Line	“\r\n”	Carriage Return followed by a Line Feed

Example Extended Address Record in Intel Format

:020000021000EC

**End of File Record**

<u>Char Pos</u>	<u>Field Type</u>	<u>Value</u>	<u>Description</u>
1	Record Start	“.”	
2-3	Data Byte Count	“00”	Always 2 bytes for this record type
4-7	Address	“0000”	Transfer Address (usually be zero)
8-9	Record Type	“01”	End of File Record
10-11	Checksum	“ZZ”	Zero minus the two's complement addition of all data hex values
12-13	End of Line	“\r\n”	Carriage Return followed by a Line Feed

Example End of File in Intel Format

:00000001FF

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